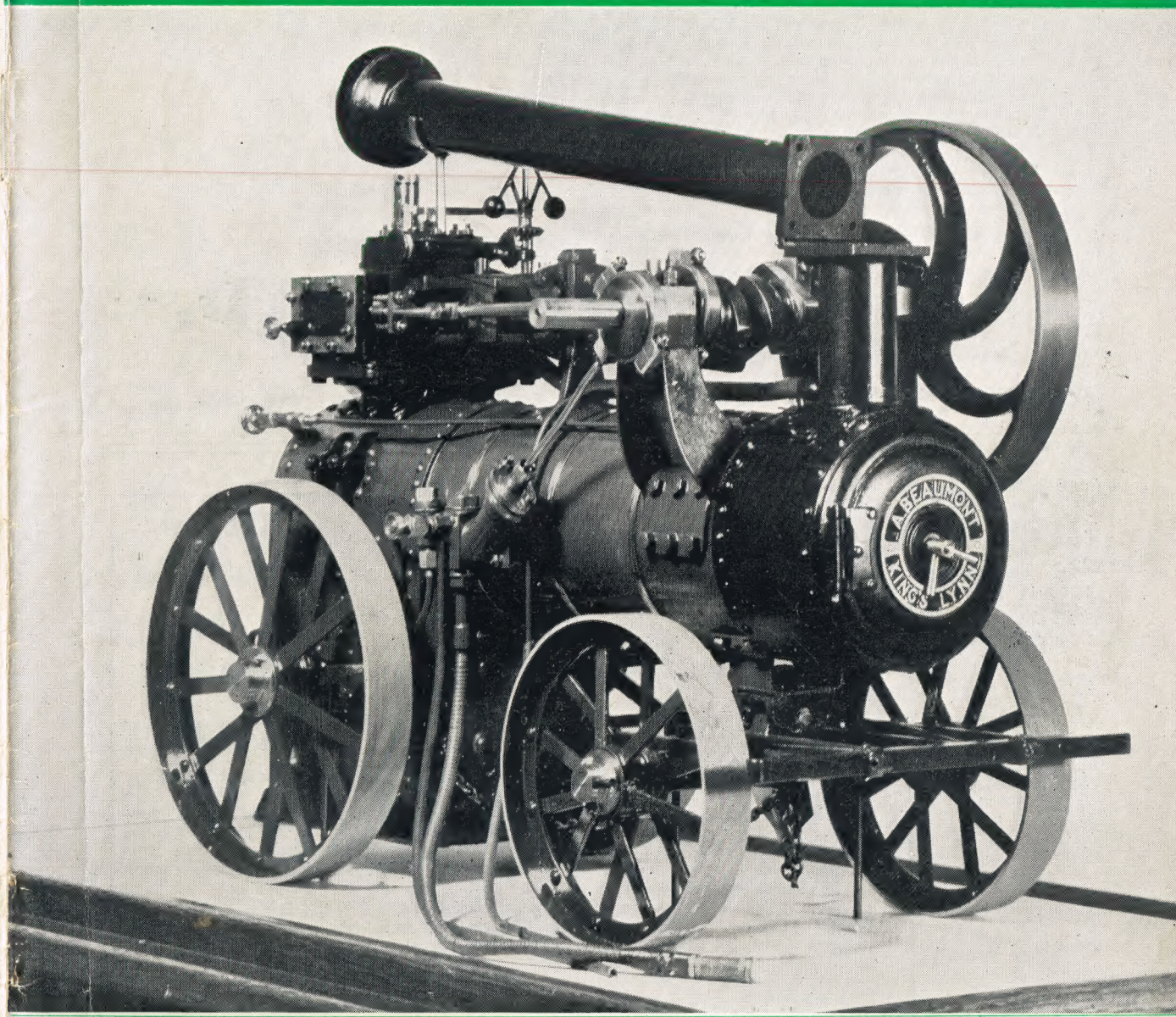
Model Engineer

THE MAGAZINE FOR THE MECHANICALLY MINDED



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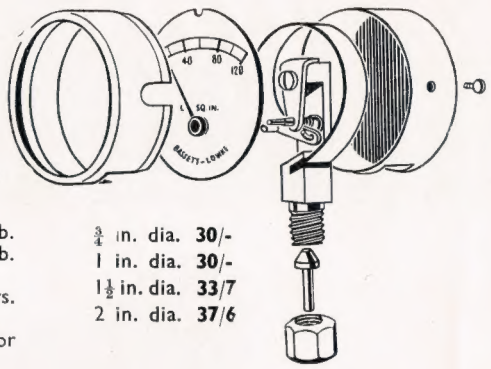

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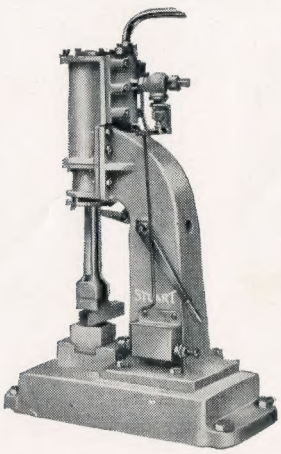

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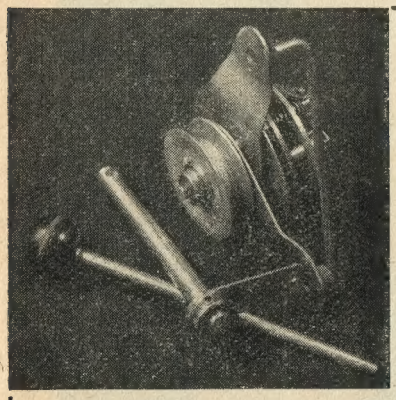

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Model Engineer

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Our Christmas Number

Christmas reading

Novelties: Edgar T. Westbury describes some items that can be made for presents or the Christmas occasion

Shopping: Joseph Martin guides you round the counters in search of that suitable gift

Oxley ? Who can presume to forecast the actions of a genius ?

The Editor is pleased to consider contributions for publication in MODEL ENGINEER. Manuscripts should be accompanied by photographs and/or drawings and should have a stamped addressed envelope for their return if unsuitable. None of the contents of MODEL ENGINEER may be reproduced without written permission. All correspondence should be addressed to the Editor, Model Engineer, 19-20 Noel Street, London, W1.

Smoke Rings

A WEEKLY COMMENTARY BY VULCAN

IT was an extremely difficult matter to decide the most suitable recipient of the Portass lathe which was offered through these columns recently. More than 100 letters were received, establishing beyond doubt that there is a wealth of youngsters who are keen on model engineering in all its forms.

The Editor read the letters and finally recommended that the lathe should go to David S. Harland, of 16 Cornwallis Terrace, Hastings, Sussex. Harland is 17 years of age and a member of the sixth form of Hastings Grammar School. He hopes to gain admission to a British Railways Sandwich Scheme for the Diploma of Technology (Engineering).

Building "Tich"

He has been a member of Hastings and District MES for two years and has held the office of treasurer for the past year. He is keen to be more active in model engineering and is being helped to build a *Tich* by Mr L. J. Markwick, of St Leonards. He cycles to his house once a week to use Mr Markwick's workshop.

The north countryman who offered to give the lathe to a deserving youngster has agreed with the Editor's choice and I hope that by the time these words are in print the Portass will have found a new home at Hastings.

Many thanks to all who wrote most heartening letters; I am only sorry there are not lathes to go all round.

Speed under sail

I WAS interested to read an article the other day by the late Capt. J. S. Learmont on "Speed in Sail." It was in the *Mariner's Mirror*, the quarterly of the Society for Nautical Research, of which he was a member.

In connection with his subject, Capt. Learmont raised the question of the fantastic records of 450 miles or so per day claimed for some of the American clippers of the 1850s. Compared with later records, such as 363 miles per day for *Cutty Sark* and 370 for the big German five-master *Preussen*, they seem wonderful, but Capt. Learmont argues very convincingly that they are not true. He had considerable experience in sail and was credited with some record passages, and he ought to know what he was writing about.

Not confirmed

He points out that the figures for the American ships were not verified at the time, as were the later records, and that they are not confirmed by such of the master's logs as are still available. From his own experiences in the iron ship *Brenhilda* and the steel four-mast barque *Bengairn*, which he found were strained to almost breaking point when doing 16 knots or so,

Smoke Rings . . .

he states that a soft-wood ship would not stand up to higher speeds.

Some of the records were claimed for maiden voyages, but for the first year or so the rigging, which was of hemp, had not had time to stretch and settle down and, as he says, " you cannot drive a ship with slack rigging."

Although the early records have been published in *Lloyd's Calendar*, and for years have been generally accepted, the article referred to confirms the doubts held by many thoughtful people as to the wonderful performances of these early clippers.

I think we may safely assume that the figures given for the later ships represent the best that has ever been done under sail, and that the British clippers *Cutty Sark*, *Thermopylae*, *Ariel* and the others, not forgetting the famous P liners of the Germans, may claim to have been equal to the best of them.

Branch line train

SOMETHING different in railway traction will be seen in Scotland next summer when British Railways experiment with a new form of railcar in an endeavour to meet the problem posed by uneconomic branch lines.

The vehicle, a twin-coach unit seating 117 passengers, closely resembles a lightweight diesel but it is electrically driven and powered—wait for it—by batteries !

The advantage of this type of vehicle, which, incidentally, has been in use in Germany for some years, is that it avoids the heavy expense of installing an elaborate distribution system along the line. Moreover, the bulk of the electricity can be taken in off-peak hours.

It is intended to experiment with the unit on the 43 mile run between Aberdeen and Ballater, the batteries receiving a boosting charge at each terminus and being completely recharged at night.

This section of the line has 12 stations and a maximum gradient of 1 in 68 so the acceleration and climbing capabilities of the battery railcar will be amply tested.

British Railways say that the present timetable, at present worked completely by steam trains, will be increased from four to six trains a day in each direction and three of these services will be met by the new car.

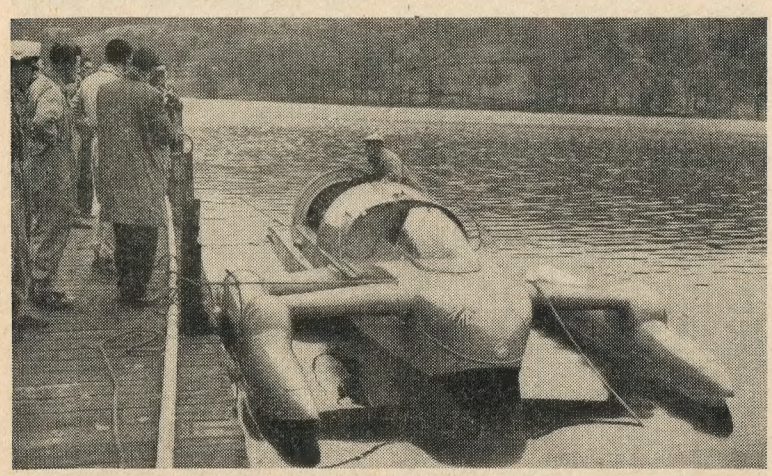
Whatever else it does, the battery car is expected at least to equal the performance of the steam trains but its potentialities will be closely watched with the possibility of introducing this type of locomotion to similar lines.

For shopping

On reflection it seems that this form of traction has been sadly neglected, not only by public transport authorities but by commercial and private interests.

For a firm making a large number of small deliveries in the congested area of a city centre I would have thought that a battery-driven van would have been ideal, yet bakers and milkmen seem the only users.

And for the rural housewife, and those households where a second car is essential, a lightweight battery-powered runabout seems the complete answer.



Donald Campbell's jet-engined BLUEBIRD *in which he set up a new water speed record of* 239 *m.p.h. Pictured in the cockpit is Leo Villa who warned Campbell by radio when* BLUEBIRD *was lifting too far from the water. This timely message may have averted a disaster*

Cover picture

A twin portable engine built by Mr Beaumont, of South Wootton, King's Lynn. This was one of the entries in our recent photographic competition.

It might not be fast, but it is reasonably powerful; it is reliable, easy to maintain, simple to drive and can be left out in quite severe frosts without fear.

Woman enthusiast

IS there a model engineer in Britain who has a model traction engine or road roller measuring not more than about 12 in. in length, which he is prepared to sell to a woman who is keenly interested in mechanical models ?

This request comes from Miss Phyllis Pendry, of Middlesex, a regular reader of MODEL ENGINEER, who for the past two years or so has found model engineering fascinating.

She has made several models herself, though she admits they are not in the tradition nor to the strict standards of workmanship associated with the model engineering movement.

Having a flair for music, her miniatures have a musical atmosphere. She has built a toy replica of a consul cinema organ, gaily illuminated with coloured lights, which, to the accompaniment of a tinkling musical box, rises from a box-like orchestral pit.

No fuel problem

Based on the famous revolving stages of the London Coliseum and Palladium is another model, again profusely illuminated, which displays a consul organ in one sector and the setting for a band, minus instruments and instrumentalists, in the other.

Lighting is provided by a step-down transformer which converts household current to 4.5 v. The bulbs are 4.5 flashlamp bulbs, and one model has no less than 49 of these carefully soldered into position. Colours are obtained by tiny gelatine filters.

Miss Pendry's ingenious method of supplying current to the revolving model intrigued me when I saw these models at her home. The collecting mechanism is simply a wire loop about which a Meccano pulley slides. Elementary, isn't it ?

Reverting to the traction engine, Miss Pendry does not mind whether it is propelled by steam or electricity. She will certainly have no worries in securing the right type of fuel for a steam-driven one for her father is a coal merchant !

STEAM CAR DESIGN

In this concluding article GEORGE W. McARD has some important points to make on the chassis and bodywork

Illustrations by courtesy of Revue de l'Aluminium

At this stage consideration should be given to the underframe for supporting the engine, generator and other parts, especially if this is to be made in the home workshop.

As already indicated, the speedier way of acquiring a steam car is that which provides for the purchase of the chassis with front and rear wheels, etc., from a first-class motor firm, and where this can be arranged considerable benefit will accrue. To satisfy oneself as to the best unit for one's purpose it is necessary to have some means of inspecting as many modern cars as possible, preferably in a big garage while in process of repair.

If the entire frame structure with its cross members is reasonably in line with the proposed layout and the total load on the two axles at wheel treads approximately similar, the next stage is one of negotiation with the makers. If, however, a new chassis is envisaged, I should strongly advise restricting your own construction to the actual underframe, purchasing the running gear—wheels, axles, brakes and so forth—from reputable makers.

The frame may be of steel or aluminium, but as the production of a unit formed from extruded aluminium sections should be a much easier proposition for a private builder, this design deserves most careful study. A considerable saving in weight is possible without loss of strength and the individual members may be welded with every assurance of dependability, expert assistance being at the disposal of every responsible worker in this field.

If any further claim is necessary, the fact that aluminium is in use on heavy road vehicles in this country should allay any anxiety as to its strength—and, remember, the shock stresses in the proposed underframe can never even approximate to those in heavy transport units.

It should be possible to produce a good layout of engine and generator, including auxiliaries, fuel and water tanks, battery and other incidentals, this operation being most useful from several angles. It will enable the builder to assess more effectively the problems of subsequent operation and maintenance, afford him some idea of the piping and wiring that will be necessary, and, assuming he is able to estimate the weight of each main unit in working order, he will be able to determine the weight coming on each tyre at the tread.

This weight-distribution problem is easily solved by mechanics, providing you can properly assess the individual component weights with reasonable accuracy, and it is desirable to aim for equal loads at the tread for each wheel to ensure safe steering and effective adhesion for driving.

The diagram (Fig. 13) gives a good impression of one possible layout—in this case with the generator at the front of the car. The engine position is fixed by the straight drive through to the rear axle, and the auxiliary fittings, if engine driven, will have their location settled by the source and type of their drive, and so on, with batteries and tanks arranged to afford good access for filling and inspection.

When planning the general disposition of the major components you will need to bear in mind the design you propose for the car body and its seating arrangements in order that these prove practicable after you have carried out your road tests on the chassis; the opposite has happened on odd occasions—also faulty weight placing—and a reshuffle of components can seriously delay the final stages of the car's construction besides creating a further drain on your resources.

THE BODY

Although many enthusiasts will undertake the production of the bodywork, few outside this branch of work will be expected to make as good a job as the average bodybuilder. And how provoking to learn this first-hand when you have to ride on a machine for years with bodywork which creaks and groans mile after mile !

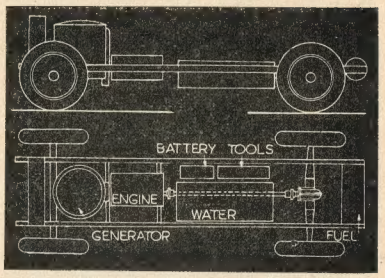


Fig. 13: *Possible car layout*

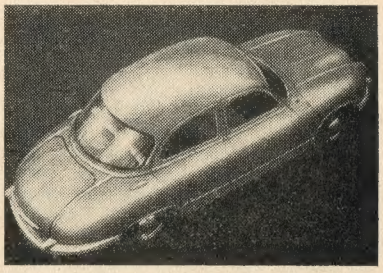


Fig. 14: *The Dyna-Panhard car with aluminium body*

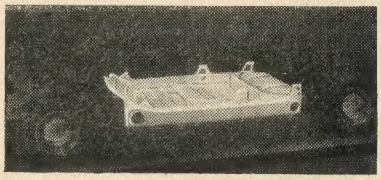


Fig. 15: *The three-unit assembly of the DP car, with aluminium flooring and base for the bodywork before linking up*

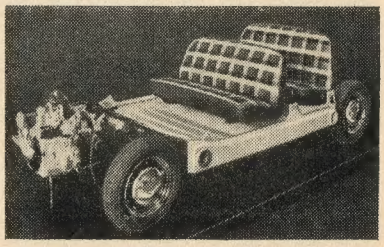


Fig. 16: *The wheels and platform after linking up the DP units*

If you have any doubts as to your ability in this direction, design the essentials of seating and door arrangements, roof and side lighting, boot and provision for luggage, then decide on the amount you can afford to pay the expert, and endeavour to interest him in your project. If he is a craftsman and artist, he will give you a quarter-scale drawing showing his proposition from every normal angle and, when approved, will make you a clay model if your price permits.

This, at any rate, is the procedure adopted by the motor experts before any new design is undertaken, and if this should be your good fortune you can, after approving his proposal, concentrate on the type of construction and the details for such parts as windows and door fastenings, headlight arrangements, and the hundred and one other details that go to complete your car.

In addition to the more orthodox form of bodybuilding by the use of steel sheet presswork, there are two other constructions which are gradually coming to the front. One of these is by the use of aluminium extruded sections for framing members and door side pillars, the pieces being fitted carefully to form the whole with each joint securely fixed by welding. This design has the merit of light weight plus consequent ease of handling and manipulation, and facilitates any repair that may be occasioned. A fine example of a car fitted with a works-built aluminium body is the Dyna-Panhard machine (Fig. 14).

Admittedly, no individual engineer could produce component sections in any way comparable to this example, but for the benefit of those readers who realise the value of aluminium as a medium for the private builder, several pictures of this car are included.

The design of the machine takes the form of a three-piece unit, i.e., front axle (with drive complete), rear axle, and an intermediate substructure formed of two side rails and three tubular crossbearers—one between the front wheels and beneath the driver's feet, one beneath the rear seat and between the rear wheels, and the third under the front seat. The floor, suitably grooved for rigidity, is laid over and secured to the tubular members.

As seen in Figs 15 and 16, the complete chassis results from a union of front and rear axles to the centre sub-structure upon which the body is then built, the first body sectional member being seen in position in Fig. 17 and the final in Fig. 18.

An alternative method of construction to that using steel or aluminium is that which uses a plastic formation, and few motoring experts could distinguish, so far as appearances are concerned, between steel, aluminium and plastic. An excellent example of this method is the Jensen saloon car (Fig. 19), the plastic body for this machine being built on a production basis that permits a first-class job at an attractive price.

The body panels are formed of polyester resin-reinforced glass fibre, and this process lends itself admirably for the steam car since capital outlay on tools is relatively low; moulds may be of a simple and inexpensive character, and the need for skilled labour in their production is minimised. It is remarkably strong notwithstanding its low weight (this form of construction is the lightest possible) and, in many cases, designs may be produced which would not be possible in either of the alternative procedures.

Floorboards should be of plywood, not less than five-ply thick to complete a really excellent structure, and so far as external painting is concerned, this can be carried out in the usual manner.

STEAM CONSUMPTION

Assuming engines of good design carefully maintained in service and provided with valves and operating mechanisms which are capable of variation in cut-off, steam consumptions have been obtained as follows:

Type of Engine	Steam Rate (BHP-hr)
Simple expansion, with poppet valves	12 lb.
Compound expansion, with piston valves ..	10-10½ lb.
Compound expansion, with poppet valves ..	9 lb.
Compound expansion, with poppet valves and Re-heating of steam between expansion stages	8 lb.

Cams cutting off at 20 per cent, 50 per cent and 75 per cent will give economical operation at the bottom end of the scale, and extremely high power at the opposite end, assuming cylinder clearances are kept low and adequate compression afforded. If a compound engine is proposed the piston type of valve may be preferred, this having been used to good purpose in the Doble cross-compound engine.

WATER TANK

The location of the water tank will be settled by various considerations; naturally it will be fitted where space is most available, remembering the pipe leads that will be called for, and the need for filling from time to time.

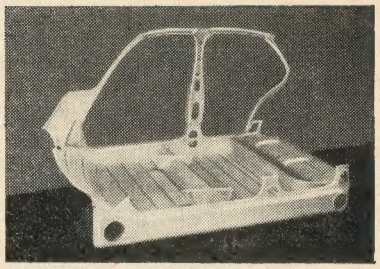


Fig. 17: *First operation in assembling the body framework for the DP car*

Its shape, however, may be made irregular if desired, to conform to the most convenient recess, and if made from aluminium its production, to any reasonable profile desired, should present no difficulty.

When designing your tank, however, remember that the tank will require cleaning out from time to time. A filter is essential, also a settling zone with emptying plug in order to facilitate cleaning inside. Capacity will be settled according to the size of your engine, but if an efficient condenser is provided the large tankage formerly provided on steamers will be found to be quite unnecessary. The water tank on the Doble car has a capacity of 17 gallons.

FUEL TANK

If possible the fuel tank should be located across the rear of the car, and, as a cylindrical form is the ideal, it might be of welded sheet steel or aluminium, with a capacity settled by the possible demands of the generator. If weight considerations permit, err on the generous side as to its volume, remembering that fuel oil is barely 8½ lb. per gallon, as against 10 lb. for water.

LUBRICATION

So far as the chassis gear—springs, brakes, etc.—is concerned lubrication will follow normal motor practice, but that for the engine cylinders is another problem.

The usual method here is by mechanical lubricator which forces the requisite number of drops per minute

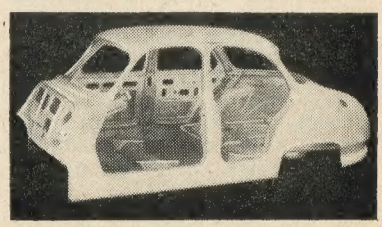


Fig. 18: *The completed body structure for the DP car*

into the steampipe from generator to engine. Sometimes the oil is sprayed by steam through atomisers into the working chambers of the engine, but whichever scheme is followed may have repercussions when the exhaust steam traverses the condenser, and again later when the condensate is fed back to the generator.

For this reason investigators have carried out much intensive research and many tests to discover a means of lubricating cylinder walls and piston rings without detriment to generator and condensate. This has been made possible by the simple means of introducing colloidal graphite mixed with paraffin into the feed water tank; for this a large measure of credit is due to two famous pioneers in steam car development, Mr L. L. Scott and Dr E. C. Newcomb.

For the driving mechanism of the engine—which should be enclosed in an oiltight casing—I would provide a small pump in the well of the sump. Its correct location would guarantee

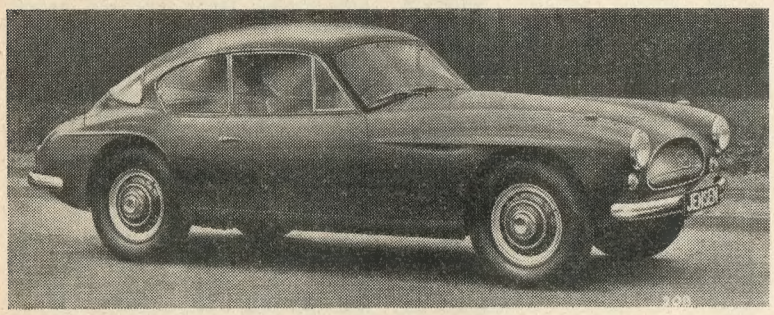


Fig. 19: *A Jensen car with plastic body* [*Jensen Motors Ltd*]

self-priming, and pipes could be arranged to force the oil spray to all vital surfaces. Access for periodic inspection of the drive, also the oil level, would be by the door in the top of the casing.

COST OF PRODUCTION

A careful record should be kept of the material and labour costs for later assistance when successful tests have brought the car into the public view. If the record has been written up in a businesslike manner, it should be possible to arrive at a price for a complete machine for an interested inquirer at any time, making due allowances for variations in material costs, as also in labour charges.

To help forward the marketing of an attractive steamer all costs should be kept to a minimum, with no time wasted at any stage, since labour costs usually form the biggest debit. Special allowance will be made to cover the experimental section of the work done, and a separate order number should be allotted to which time for that section may be debited.

MASS PRODUCTION

While planning the design and production of the car and its details, the possibility of its ultimate manufacture on a mass-production basis should be kept to the fore. The opinion of many knowledgeable motor engineers is even more favourable to the mass production of steam cars than to that of the i.c. machine, strange as it may seem.

The entire car can be resolved into 12 main components—generator, engine, transmission, chassis, wheels and axles, suspension, brakes, steering gear, electrical equipment, tanks and condenser, pipes and fitments, and bodywork—and a comparison of these with leading sections of an i.c. engined car will confirm the greater advantages of the steam car under this heading. Many groups could profitably be sub-contracted where parts are duplicated with those already going through another factory, the wheels and axles, springs and gear, steering gear, brakes and condenser being a few taken at random.

MANAGEMENT AND MAINTENANCE OF CAR

The first section of this heading is so vital to the ultimate popularity, or otherwise, of steam cars that it would be well to bear this fact in mind the whole of the time your design is in progress.

The big asset of an i.c. car lies in the fact that any fool can operate it and get what he wants—for the moment at any rate—out of it without having any mechanical knowledge whatever. Early steam cars with fire-tube boilers called for very careful handling, and that fact alone gave the flash generator a big pull. Let your operation from start to finish of every run be as easy as your i.c. rivals, and your machine is already assured of an interested buying public.

The subsequent care of the car depends on your outlook on life and the size of your bank balance, but it has been well said that of all automobiles the steam car is the only machine that will give the careful owner a lifetime of good service if handled on the road with care and maintained as such a unit deserves. Any machinery which is well made in the first instance and not continually overloaded in service will last a long while, and the steam car, like the steam locomotive, is no exception.

Regular lubrication to vital points, plus adjustments when called for, will eliminate many failures, just as regular and careful examination of your tyres will prolong their life.

INSURANCE

Some time ago I contacted a leading insurance company with the view of ascertaining what charges a steam car owner would be faced with, and discovered that we still appear to be living in the days when a man with a red flag walked in front of a car. The Board of Trade have regulations that call for the separate insurance of the boiler, also its inspection at specified periods. These demands, of course, presume a unit which contains considerable volumes of water and steam at relatively high pressure, like the early traction engines. Such an attitude is absurd where a flash generator is fitted, as the possibility of explosion with such is practically nil. I feel confident that the owner of a really well designed and built steam car would have no difficulty in obtaining equivalent rates to those imposed on an i.c. machine of similar rating.

REGISTRATION

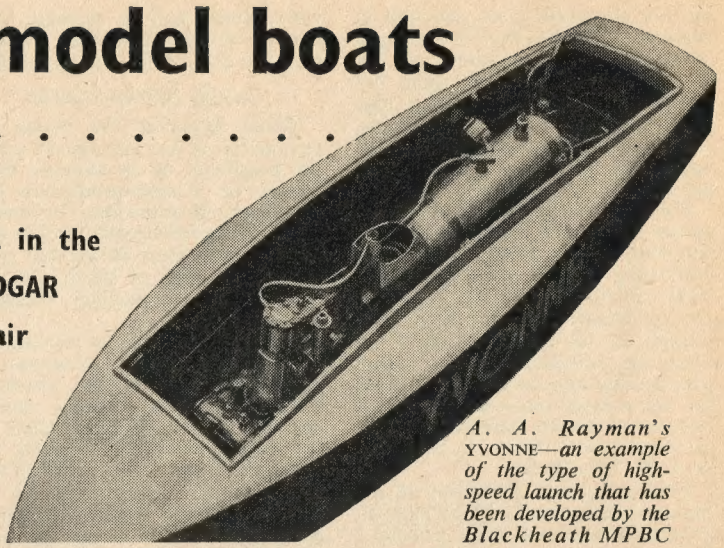
Curiously enough, the licensing authorities require, as in earlier days, to be informed of the effective heating surface of the boiler, and I believe my remarks on insurance charges would apply here also. It would be as well to make inquiries before starting on what is, after all, a big venture. ▣

NEW PIPELINE IS 180 MILES LONG

A new 20-in. dia. pipeline is carrying natural gas from the La Paz oilfield, in the Maracaibo district of the state of Zulia, to the Cardon oil refinery on the Paraguana Peninsula, Venezuela. Costing £9,000,000 and built in 12 months, the line is 180 miles long and has a nominal capacity of 100 million cubic feet per day.

Power for model boats

Steam engines and boilers . . . in the third article of this series EDGAR T. WESTBURY has much to air on this aspect of the hobby



A. A. Rayman's YVONNE—*an example of the type of high-speed launch that has been developed by the Blackheath MPBC*

POWER navigation, both in full-size practice and in models, owes its origin and major development to the steam engine, and though it now has a serious rival in the internal combustion engine, its possibilities for the propulsion of marine craft, whether large or small, are by no means exhausted. The mechanical enthusiast will find plenty of interest —and no lack of new worlds to conquer—in the design and development of steam plants for model boats.

The many readers who uphold the slogan "there's nothing like steam" will probably applaud me when I state that no form of motive power other than steam offers so much scope for variety and the production of realism in the design and arrangement of propelling machinery in model prototype ships. Steam engines can be built in almost any scale, and, if not absolutely faithful in detail, at least bear a passable resemblance to full size and are capable of reasonable working performance. It is thus possible to make the engine room of a model steamboat true in general character to that of its prototype, in a way which is practically impossible with other types of engines.

Perhaps these readers may not be quite so pleased with me, however, when I say that only rarely is full advantage taken of these unique possibilities. Steam engine constructors, as a class, are far too complacent and unimaginative in their approach to the marine application of these engines. Whereas the constructors of model locomotives will take the utmost pains to obtain fidelity in the appearance of the mechanical features of their engines, the model boat builder will cheerfully fit engines and boilers resembling nothing that ever was—or could be—in marine practice, confident that installed below decks they are not only out of sight but also largely out of mind. So long as the engine performs its function in pushing the boat along at a reasonable speed, little interest is taken in its character or appearance. And though details may vary widely, one or two conventional types of plants have always been predominant.

The constant buzzing of this particular bee in my bonnet may possibly be found irritating to some of my readers. I make no apologies; on the contrary I hope that it will *sting* some of them into action ! I see no reason why boat builders should spend so much time and trouble on the non-functional external trimmings of their models and yet be satisfied with internals which shatter all illusions of realism at a single glance.

I do not condemn the type of boat which is built purely to serve a practical purpose and is as simple both inside and out as is consistent with utility, but what I do say is that those to whom the term "model" implies the best possible representation of a well-loved prototype might make much better use of the special opportunities which the steam engine affords towards attaining this end.

TYPES OF STEAM PLANTS

The most popular form of installation in model steamboats has always been the orthodox double-acting vertical engine and the internal-flue boiler, heated by a petrol or paraffin blowlamp. As I have pointed out in my articles on utility steam engines, this is a practical and reliable type of plant which has stood the test of time and has many solid and homely virtues.

In the first place it is difficult to improve on this general form of engine for running at moderate speed and power on saturated, or not too highly superheated, steam. Secondly, the boiler, though thermally inefficient and heavy for its output, is of a convenient form for installation in a hull, being long and narrow and having a low centre of gravity. The large water capacity enables it to steam with minimum pressure variation and little or no replenishment of feed water, while blowlamps, though they may give trouble at times and are not the most efficient means of heating a boiler, are highly convenient and will provide constant heat over a long period.

These features simplify management, especially in view of the fact that a model boat must necessarily be capable of looking after itself for at least a brief period—and sometimes much longer than is bargained for on the Lloyd's schedule !—out of reach of human control or intervention.

Simple steam plants of this kind are made with one or two cylinders—rarely more—and there is little to choose between them in general performance. Perhaps the most popular engine of all is the Stuart No 10 vertical ($\frac{3}{4}$ in. bore × $\frac{3}{4}$ in. stroke), either single or double, which has been going strong for many years now; the usual boiler is the so-called "centre-flue" type (though the flue is a long way out of centre), obtainable from such firms as Bond's o' Euston Road, and Bassett-Lowke Ltd.

Another popular engine available in

either single or double-cylinder form, and of the same bore and stroke, is the Warrior*, which can be used in conjunction with a similar boiler or with the Trident* type, which has a "dry-back" internal combustion chamber and double-return flues, thus affording higher thermal efficiency than the former type, by considerable increase of effective heating surface.

The Warrior engine was first described in MODEL ENGINEER between 10 February and 10 March 1949, the Trident boiler, Mark I and II, in the issue of 13 May 1954, and a torch blowlamp suitable for these boilers, 8 July 1954.

The Double-10 or Warrior engines are capable of driving prototype boats up to 6 ft in length, at a speed of three to four miles per hour, always assuming that sufficient steam is available. A pressure of about 50 p.s.i. is generally high enough to give this performance, and, while higher pressures will obviously increase the power, they often introduce problems of their own, i.e. in lubrication, wear and tear, and boiler management. The single cylinder engines of these and similar sized types are suitable for boats up to about 4 ft in length.

Smaller engines

A number of smaller engines are also available from the firms mentioned, a comparatively recent example being that introduced by Bond's o' Euston Road and reviewed in ME some time ago, together with the internal flue boiler and spirit blowlamp specially designed for it. This has a bore and stroke of $\frac{7}{16}$ in. and will give a good account of itself in a 3 ft hull.

The Trojan* engine of $\frac{5}{8}$ in. bore × $\frac{5}{8}$ in. stroke, described in ME of 10 February 1949, has given excellent results in tugs and other "hard-slogging" types of boats of three to four feet in length.

As I am advising readers particularly on the propulsion of boats suitable for regatta competitions, I will not say much about the ultra-simple plants, such as those with tiny oscillating engines and spirit-fired boilers, because although some of these have had a certain degree of success in this field, they are the exception rather than the rule. It takes a sturdy engine to stand up to the hard work and the buffeting that a boat receives on the open pond in the kind of weather normally encountered at regattas.

Nevertheless the mechanical simplicity of these plants may be an asset, provided that they are well built, with accurate working parts and adequate bearings; the ME Basic Marine Steam Plant* can be recommended in this respect.

By way of improvement from the standpoint of realism, the larger sizes of boats may well be fitted with compound or triple-expansion engines, and Scotch or other types of marine boilers. These certainly get much closer to the real thing, but their complication is rarely justified by any increase in efficiency, so that they are not highly popular among builders who are mainly interested in working results.

To obtain the potential advantages of expansion in more than one cylinder, I consider that a condenser and air pump are necessary, but the surface type of condenser is difficult to model in an effective form, and the jet condenser, though offering possibilities, is not typical of marine practice.

Improvement in the speed of model steamboats can be obtained by the obvious course of fitting more powerful engines, either of orthodox type or of a specialised type more suitable for running at high speed. Increased steaming capacity is, of course, essential and is more important than increasing the size or potential performance of the engines—though the design of the latter must be adapted to stand up to the higher power.

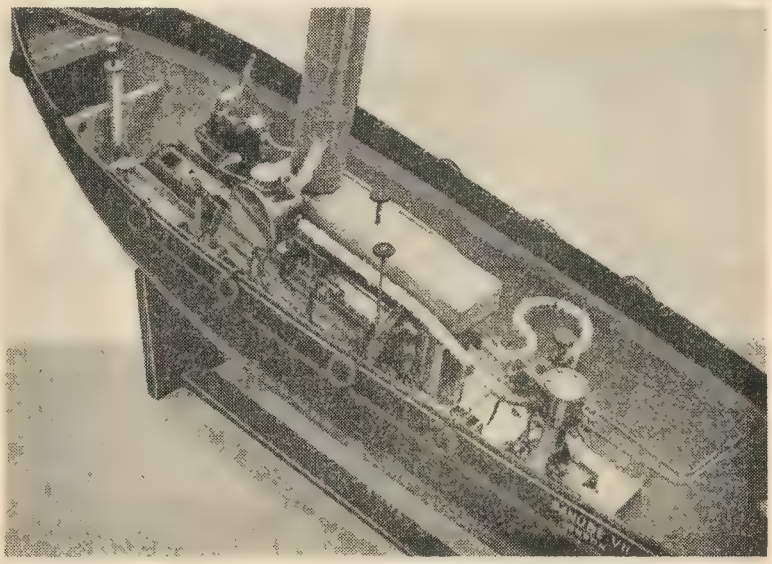
A very good example of the high-performance steamboat is that which has been developed over a number of years by Blackheath Model Power Boat Club. The details of individual boats vary, but generally speaking, they have single-cylinder double-acting engines of about $\frac{3}{4}$ in. bore × $\frac{3}{4}$ in. stroke, strengthened in structure and otherwise improved, and water-tube boilers which are lighter, quicker in steaming and better adapted to high pressure than the internal flue type.

One of the pioneers in this class of boat was Mr H. Jepson, one of whose engines (a ball-bearing enclosed type) was recently described in ME. Other exponents in this club are Messrs J. H. Benson and A. A. Rayman.

In most fast steamboats, however, the orthodox double-acting engine is superseded by the single-acting type, generally based on the form of engine which was developed for generating electricity in the early days. This does not resemble any full-size marine propulsion type, but is highly suited to working at very high revolutions per minute and for standing up to high pressures, by the reduction in the weight of reciprocating parts and the elimination of packing glands. The best known commercial designs of these engines are the Stuart Turner Sun, Star and Sirius engines.

Water-tube or flash boilers may be regarded as essential for really fast boats owing to the necessity for increased boiler power in relation to weight. Except for quite short runs, engine-driven feed pumps must be fitted, as there is little or no water reserve capacity. It is not usually possible to employ the most efficient type of water-tube boilers owing to limited space and, particularly, height; these boilers tend to require much more head room than horizontal internal flue types and, thus, it is difficult to keep the centre of gravity low enough for proper stability of the hull.

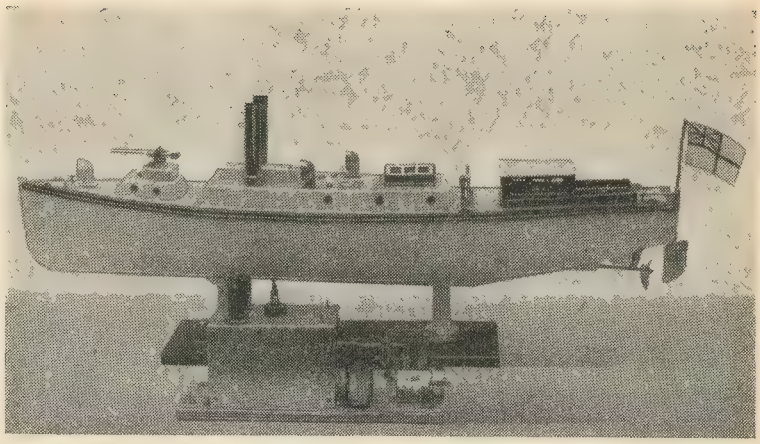
The normal form of blowlamp is



The engine room of A. Falconer's model steam tug DANUBE VII, *showing the Stuart No* 10 *engine and horizontal centre-flue boiler*

not ideal for firing water-tube boilers, but little development of more efficient diffused flame burners seems to have been carried out in recent years. Nevertheless it is not at all difficult —with efficient forms of light hulls— to obtain quite brisk speeds of six to eight miles per hour with boats in this class.

Many readers may think that these speeds are not very great but in fact they are quite spectacular, and most observers think that the boats are running a good deal faster than they are. The rules of the MPBA limit the speed of free-running craft to 12 miles per hour, and very few boats approach this speed apart from tethered racing boats, and at present I am not concerned with these.



A model steam pinnace by F. G. Arkell, with the twin single-acting engine and water-tube boiler shown separately

POWER OF STEAM PLANTS

While I am still making no definite attempt to assess the relationship between power and speed in any particular class of boat, it will be helpful to set some idea of the power which one might expect from a steam plant of a given size—if only for comparision with other forms of motive power.

Generally speaking, the prospects are far better than those of electric motors, though, once again, I must emphasise that the limiting factor is not the size of the engine but the steam supply available. It is often better to fit a small engine which can be adequately supplied with steam than a larger and potentially more powerful one which cannot be fed at full capacity.

There is, however, a possibility, rarely exploited, that a specially designed engine with large cylinder capacity and short cut-off might enable the expansive properties of the steam to be better utilised, and steam economy thus improved.

In a comprehensive review of steam engine efficiency it would be necessary to start with the calorific value of the fuel, which is the original source of energy. But as there are no reliable data on the efficiency of combustion and heat transfer in model boilers, it is idle to attempt to make calculations as to the amount of steam which can be obtained from a given quantity of fuel. Even an electronic brain could not work out a problem in which nearly all the factors are Xs ! One thing which can be said is that thermal efficiency in these plants is very low, indeed, and such results that are gained are due to the rule of the " big stick "—applying as much heat as we can, and hoping for the best.

I mention this because innumerable readers have written to me asking for " formulas " to cover the various problems in design, such as heating surface of boilers, burner efficiency and evaporation per unit of fuel consumed. In the past, writers on model steam engines have—perhaps rashly —attempted to formulate rules of design. But even when based purely on practical experience, they are liable to go sadly astray when applied to experimental problems.

Model engineering is a notoriously inexact science, and, in the absence of the masses of data on full-size engineering (most of which have been accumulated by the patient labour, not to mention the blood, tears, toil and sweat of countless searchers for knowledge), we must be content to grope our way to the attainment of efficiency. We live in an age when the words " formula " and " blueprint " are credited with almost magic significance, but they are no more capable of working miracles than the abracadabra of alchemists in the Dark Ages.

However, for the purpose of discussion I will bypass the awkward questions of boiler and burner efficiency and assume that you have sufficient steam for supplying the engine at its rated pressure—thus at least you can get a good idea of the horse power which it will develop. And at this stage you can confidently apply a good old-fashioned and accurate formula which will give the internal or " indicated " horse power as developed in the engine cylinder, though the actual power delivered at the shaft will be subject to depreciation by reason of friction in the working parts.

The formula for i.h.p. is $\frac{PLAN}{33{,}000}$, where P is the mean effective working pressure in pounds per square inch, L is the length of stroke in feet, A is the piston area in square inches, and N is the number of power strokes per minute. The factor P cannot be determined with close accuracy unless it can be actually measured from indicator cards, but in a well-designed engine working at or near full-stroke admission it is usually somewhere near half the boiler pressure.

If you take a double-acting engine of $\frac{3}{4}$ in. bore $\times$ $\frac{3}{4}$ in. stroke, running at 1,000 r.p.m. on a steam pressure of 50 p.s.i. the figures are as follows: (P = 25 (assumed), L = 0.0625, A = 0.4418, and N = 2,000) = 0.0418 i.h.p.

Assessment of frictional losses could only be obtained accurately by brake tests, but on the strength of general experience may be assumed to be in the region of 25 per cent, so that the actual power at the shaft (generally termed b.h.p.) would be about 1/30 h.p.

Although this calculation involves some " guesstimation " in respect of mean pressure and friction, it has been found fairly reliable, and applicable to fluid pressure engines of any type and size.

As a result of general observation and experience, I have formed the conclusion that the amount of power specified above, if properly applied, is sufficient for all but the very largest prototype boats, unless one wishes to drive them at well above a realistic speed. Boats which are not true prototypes, but built for free-running competition work, are often more highly powered; a typical example is the Blackheath boat illustrated, in which the working pressure and r.p.m. are both much higher than that in the calculated example, though the engine dimensions are about the same.

* *Not available ready-made*

● *To be continued*

Beginner's Workshop

WHEEL and PULLEY PATTERNS

By GEOMETER

In the majority of cases, castings for wheels and pulleys can be produced from simple patterns, though for the more complicated types of castings with spokes—either curved or straight—the patterns themselves must be built up.

But this is not a difficult process and it has, moreover, the advantage of enabling flat pieces of wood, like boards, to be placed back-to-back across the grain to avoid warping at large diameters; and in small sizes, plywood can be used on the same principle, to provide strength where sections would otherwise be rather fragile.

Where there are no undercuts, and the boss and rim of the pulley or wheel are tapered to draw from the mould, fairly considerable "dishing" occasions no difficulty—though the pattern is preferably turned from a solid block of wood, rather than built up. It is then advantageous to employ a pair of gauges in sheet metal, marked out, sawn and filed to the profile, as at *A*, to maintain the web at its designed shape and thickness.

This design, of course, when it is for the flywheel of an engine, admits of using an extended bearing on the flywheel side, while keeping the rim, the functional part of the wheel, towards the crankshaft. After turning, the pattern can be smoothed to remove marks, using scrapers and sandpaper.

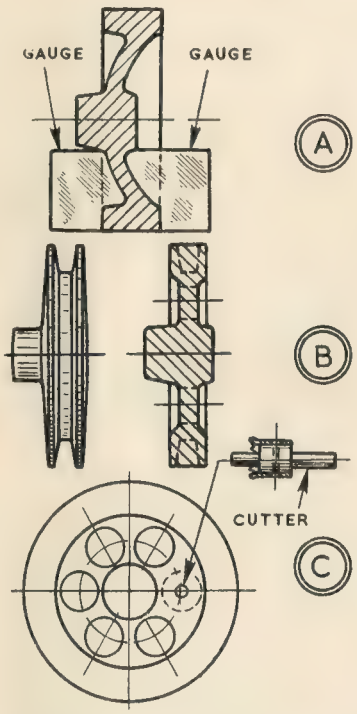
Forming the grooves

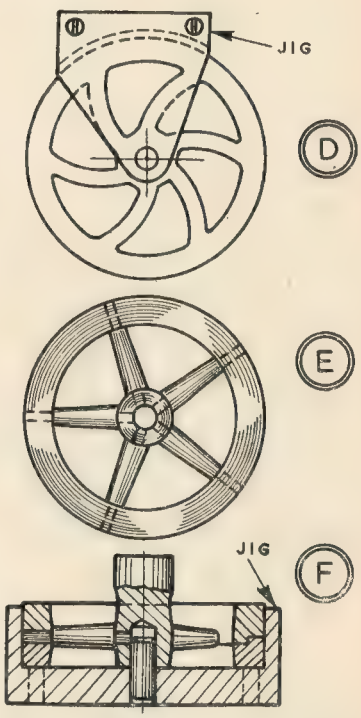
In the case of V-pulleys, little or no advantage obtains from machining V-grooves in the patterns, though this can be done, as at *B* (left), when the diameter does not exceed about 3 in. —since in large sizes, moulding such patterns is difficult. There is the disadvantage, too, that the pulley must be solid, and if it is desired to relieve the faces for lightness, then this must be done by machining the casting itself.

As it is usually desirable to save weight (and metal) by relieving the faces to form a central web, a better way is to produce the pattern as at *B* (right), then machine the V in the casting—especially as a cast V would probably need machining to true it.

For a large pulley, the pattern can be machined from a piece of flat board, relieving each side for the web, except to the centre where the boss will be—then extending the boss outwards as required with separate pieces, dowelled, tacked and glued. Such a pattern, as at *C*, may also have lightening holes for these to be produced in the casting.

On the pattern, the pitch circle and centres for the holes can be marked and carefully centre-punched, then small holes drilled to take the pilot





or guide of the trepanning cutter, which should be used from either side. A cutter of this type, particularly in small sizes, can be made from a piece of steel tube of appropriate diameter. It should be faced at the end, teeth sawn and filed, then these given a slight "set," outwards and inwards, alternate ones, for clearance like a saw. A shank can be turned to fit the bore of the tube and with a pilot incorporated, then the tube fixed with a cross rivet.

A flywheel pattern with curved oval-section spokes can be built up in three pieces—the centre with spokes, and a ring either side extending the rim, all in plywood. The apertures leaving spokes—cut out with a fret-saw—can be filed true, as at *D*, using a jig of two pieces of sheet metal, located through the boss, and bolted together outside with plywood between them. Filing and smoothing to oval section can be done afterwards.

For a flywheel with round-section spokes, these should be turned separately for the pattern and dowelled into the boss and the rim, as at *E*. Direct dowelling into the boss is possible, but the rim must be in two pieces, drilled at the joint, which should preferably be stepped for location. Assembly—tacking and gluing—in a jig (of wood) as at *F* is helpful, using a guide pin for the boss which can have a chucking piece to set up for checking truth. ▣

SCALE EFFECTS

. . . and associated problems

What is scale boiler pressure? Scale wear and tear? Scale wave formation? These are some of the questions answered by N. LAW in this informative article

I HAVE not previously seen in these pages references to scale effect or any general consideration of this problem, and I, therefore, offer the following notes with the object of provoking a fruitful discussion.

SCALING DIMENSIONS

Linear dimensions are straightforward, and if the size of the model is proportional to the size of the prototype, and the prototype to the ratio of the scale, then it follows that areas are proportional to $\frac{1}{\text{scale}}^2$ and volume is proportional to $\frac{1}{\text{scale}}^3$

Since volume and weight are clearly proportional to each other, then the weight of a model will be the weight of the prototype divided by the cube of the scale. For example, a model to a scale of 1 in. to 1 ft would have the weight of the prototype divided by 12^3, i.e.:

$$\frac{\text{Weight of prototype}}{1728}$$

SPEED

At first sight, scale speed is straightforward, and is merely prototype speed divided by the scale, i.e. the model covers the scale distance in the same time that the prototype covers full distance. This will make the wheel speed the same as in the prototype, which is generally in accordance with the aim, particularly in respect of locomotives.

On the other hand, one cannot say, for example, that a model was run at the equivalent of, say, 90 m.p.h. There is no equivalent to 90 m.p.h., except 90 m.p.h. To pursue the example of a train, the air drag at 90 m.p.h. will be at least twice as much again as the rolling resistance at this speed, and the total drag will, therefore, be the sum of the two.

A 1 in. to 1 ft model locomotive running at a scale speed of 90 m.p.h. would be making 7½ m.p.h. true speed, and at this speed, air drag would be negligible. The model will, therefore, have only rolling resistance to contend with, but this will be higher than in the prototype.

It should be appreciated that if it was desired to scale resistance accurately, the speed of a model to this scale would have to be nearer 20 m.p.h. than 7½ m.p.h. Similarly, to scale power accurately, the speed of such a model would probably be nearer 50 m.p.h., since power is proportional to the product of drag (or resistance) and speed.

In both instances, the result would be both impracticable and unrealistic, but the facts should be remembered because they bring home the real truth of the adage that you "can't scale nature."

SPEED OF SHIPS

The scaling of the speeds of model ships to represent truly their prototypes requires more thought. For example, a model of the *Queen Elizabeth* on a scale of $\frac{1}{16}$ in. to 1 ft would have a length of $\frac{1015}{16 \times 12}$ ft, i.e. 5 ft 3½ in., taking the prototype length as 1,015 ft. Since the scale is 16 × 12, i.e. 1 : 192, the scale weight of the model should be: $\frac{85{,}000 \times 2{,}240}{(192^3)} = 27$ lb.

So far, so good, but what of speed? The Queen at 32 knots (36¾ m.p.h.) is moving 54 ft each second. The model on a scale of 1 : 192 would, therefore, need to move at $\frac{54}{192}$ ft per second, to achieve scale speed. This is only about 1/5 m.p.h. The model would not have steerage way and it would be completely at the mercy of the smallest breeze on the lake. Spectators, including the owner, would be dissatisfied.

What is, therefore, a true comparative speed which will give realism, representative comparison and satisfaction to the beholder?

Now, the passage of ships through the water, especially at their maximum speed, is governed by the wave-making properties of the hull. On the prototype there may be a good bow wave, the second wave will be, say, amidships, and a piled-up wake may be noticeable close astern. Let it then be the same for the model.

The wave-making speed of any shape of displacement (as opposed to planing) hull is proportional to the square root of the water-line length, *whatever the size.*

Let us take the water-line length as 990 ft and the speed of the hull as 32 knots. We have, therefore, if speed is proportional to the square root of the length:

$$\text{Speed} = \text{constant} \times \sqrt{\text{length}}$$

$$\therefore 32 = \text{constant} \times \sqrt{990}$$

$\therefore$ Constant = 1.0 (approx.)

Let us now apply this in the same way to the case of the model which is 5.3 ft long:

$$\text{Speed} = \text{Constant} \times \sqrt{5.3}$$

$$= 1 \times 2.3 \text{ knots}$$

$$= 2.3 \text{ knots}$$

Therefore, the speed of the model to produce exactly the same wave appearance as the prototype should be 2.3 knots (2 2/3 m.p.h.).

Since this applies to all ships from models, through small craft such as motor launches, to destroyers, cross-channel boats, battleships and liners, I suggest that this is a guide of considerable value to any ship modeller.

It is further of interest to note that there is a critical speed for a given shape of hull at any scale, and at scale displacement, which is about 1.4 to 1.5 times the root of the water-line length. At this speed, however much extra power is installed to increase speed, the effect will only be to increase the size of the bow wave, the second wave will go aft to combine with the stern wave, and the ship will tend to sink into the deep trough between the two.

This effect can be observed in a

tug running free on full power. When this condition is reached, the only way to increase speed is to design a planing hull.

BOILER PRESSURE

The true scaling of boiler pressure in a scale model locomotive produces an interesting and provocative problem. The facts set out here may well cause considerable protest.

Let us consider that a locomotive is being built to a scale of 1 in. to 1 ft and that the prototype weighs, say, 75 tons, without tender, the tractive effort is 22,400 lb. and the boiler pressure 240 p.s.i. What should the scale boiler pressure be ?

Now the weight of the model, if built accurately to scale, will be the weight of the prototype divided by the cube of the scale: $\frac{75 \times 2{,}240}{1{,}128} = 97$ lb.

The fact that the model when built may be a little heavier, or even lighter, is of minor importance. The point is that the laws of friction governing the adhesion of driving wheels are laws of nature and are the same for both model and prototype.

The t.e. of the model must, therefore, bear the same relationship to its weight as does the prototype:

Tractive effort of model $= \frac{97 \times 22{,}400}{75 \times 2{,}240} = 13$ lb.

Now t.e. is proportional to the produce of boiler pressure, piston area and ratio of piston stroke to driving wheel diameter. In a 1/12th scale model, the piston area will be 1/144 of the prototype, but the ratio of piston stroke to driving wheel diameter will be the same, since the model is to scale. Now, in order that the t.e. shall be 1/1728 of the prototype, it clearly follows that the boiler pressure must be 1/12 of the protype, if this is to be achieved, i.e. 20 p.s.i.

This may well be a somewhat disturbing conclusion, but the facts are there, and they should be faced, whenever true realism is the aim to be attained.

Due allowance must be made for the fact that friction in bearings, piston rings, valves and stuffing boxes is relatively higher in the model than in the prototype, and for the fact that it is clearly an advantage for any model locomotive to have the highest t.e. that can be obtained. In practice it is further necessary to use a higher-than-scale boiler pressure in order to obtain expansion of the steam and the ability to notch up the gear.

Conceding all these points, it is ridiculous for pressures of the order of 150 or more p.s.i. to be used in a 1/12 scale model. As such authorities as LBSC say, it is not necessary, and I am trying to show the reason why: 60-80 p.s.i. is more sensible, more realistic and quite sufficient. In addition, the use of a higher pressure than is justified is an unnecessary risk.

It is perhaps a fair conclusion to draw that it is easy enough to obtain an impressive t.e. with a high boiler pressure, but it is quite something to obtain a scale t.e. with the scale boiler pressure.

POWER

The scaling of power is an interesting case which applies particularly to a reciprocating engine, whether steam or i.c. If, for example, the i.c. engine prototype of 1½ litres capacity is to be reproduced as a model of 15 c.c., what is the scale power which the model should develop ?

It should be noted that the scale in this case is not 1 : 100 but 1 : $\sqrt[3]{100}$ i.e. 1 : 4.65 and that all linear dimensions including bore and stroke will be $\frac{1}{4.65}$ of the prototype.

Power is usually defined as the rate of doing work, or the capacity to do work of some engine or machine. In this country it is customary to relate the amount of work either in ft-lb. per minute or per second to the capacity of an imaginary horse capable of doing 550 ft-lb of work per second or 33,000 ft-lb. of work per minute.

The traditional formula for any reciprocating engine is

$\frac{PLAN}{33{,}000}$ horse-power per cylinder

where P = mean effective pressure in the cylinder, L = the stroke in feet, A = the piston area and N = the number of firing strokes per minute.

In our example of a 15 c.c. model of a 1½ litre engine, it is clear that L × A in the formula is the swept volume, and this will be 1/100 of the prototype.

If the mean effective pressure and the number of firing strokes per minute, i.e. the crank shaft speed, remain the same as in the original, then the power output will be scaled exactly and will be 1/100 of the prototype. But do they ?

Take m.e.p. first. This depends mainly on cylinder head design, good breathing and compression ratio. If a scale model cylinder head design corresponds to the prototype, then further discussion does not arise. Regarding breathing, it is clearly more difficult to pass gases through small passages than through larger ones.

Although the volume of each cylinder head will in this case only be 1/100 of the prototype the inlet and exhaust passages can hardly be made true to scale dimensions, and the size of valve stems and valve guides all tend to be relatively larger than scale. Manifold and carburettor details, both as regards shape and dimensions, all tend to differ.

Compression

Regarding compression ratios, it is not normally practicable to use as high compression ratios in a model as are standard practice in the prototype. Also mechanical efficiency will be lower due to the extra power required to operate heavier-than-scale valve gear and, in particular, ignition equipment.

Taking all points into account, it is reasonable to say that prototype mean effective pressures amounting sometimes to 100 p.s.i. with maximum pressures many times this figure cannot readily be matched in a scale model. A fair conclusion is, therefore,

SCALE EFFECTS

continued

that P in the formula will be appreciably less than in the prototype. For the sake of discussion, therefore, I suggest that P might be of the order of half the value in the prototype.

As regards N, the loads on bearings, etc., are proportional to centrifugal force which depends upon the square of the angular speed and also upon the distance from the centre. In a model of a prototype which runs at 5,000 r.p.m. maximum, it will be very easy to exceed the prototype's speed by a considerable margin, purely from mechanical and structural points of view.

The power output of the engine will be limited only by its capacity to breathe. As N increases so P falls off resulting in a maximum value or peak when the product of the two multiplied together is greatest. This applies to all engines of all sizes, since P and L remain constant.

Now, our prototype 1½ litre automobile engine, if an o.h.v. design, might develop 50 b.h.p. and if a side valve design, 40 b.h.p. would be a more appropriate figure.

Our model, therefore, if run at the same r.p.m., might develop about half the scale power, say 0.25 h.p. and this would, I suggest, be a very reasonable figure for a 15 c.c. four-cylinder design. If the engine is a single-cylinder design, then appreciably higher powers can be expected from the foregoing considerations, but at some sacrifice of smoothness and reliability.

This leads, as an interesting digression, to R. H. R. Curwen's design for an o.h.v. version Seal.

O.h.v. advantages

In full scale practice modern designs are nearly all o.h.v. because (a) the o.h.v. head is a much better shape from the anti-detonation point of view, permitting higher compression ratios and hence more power from a given engine capacity, and (b) the o.h.v. design gives better breathing and quality of fuel.

In my opinion (a) does not apply to a model, particularly if it is a multi-cylinder design. Such a small cylinder has no tendency to detonate, anyway, and the gases inside, being compressed and burnt, would not know whether they were in a side valve or o.h.v. head. Also the compression ratio selected for a model is determined chiefly by practical considerations unconnected with detonation.

That leaves (b). Now R. H. R. Curwen's is a most interesting design and should work well. On the other hand, a look at the transverse section of the head illustrates my point that inlet and exhaust passages are rather full of valve stem and valve guide. Also the valve heads are thick, and both inlet and exhaust ports have right-angled bends. All these points may be unavoidable, but bearing in mind that his valve gear will take more power to drive it than Mr Westbury's side-valve design, I shall be surprised if this o.h.v. head gives much more power.

As I understand it, the head is intended to use the existing camshaft whereas to exploit the o.h.v. design for power output, a new camshaft modifying valve events to suit is needed. This would tend to lose smoothness, flexibility and low speed torque, all of which are particularly needed in a marine application. But I very much hope that R. H. R. Curwen's design is modelled.

WEAR AND TEAR

In a broad consideration of some scale effects, it is worth while to include a reference to the effect of wear on working surfaces. In general, it is true to say that for a given set of conditions regarding rubbing speed, load, materials, and standard of finish, certain conditions of lubrication will yield a rate of wear which can be predicted approximately.

It follows that if in a prototype and model you can reproduce similar conditions then the rates of wear in a stated time will be similar. Such rate of wear might be of the order of 0.001 in. per 1,000 hours running. In a 5 in. cylinder it is clear that this amount of wear would not be significant, and it is probable that at least ten times this amount of wear would have to take place before performance was materially affected.

In the case of a model built to scale, increase of clearances through wear will clearly become magnified by the scale and if the scale is 1/12 then the expected life under similar conditions will also be only 1/12.

This is largely a theoretical issue, but it should be remembered when any model is put to continuous hard work, that one year of use may be equal to twelve years for the prototype. ▣

GETTING OUT OF A HOLE . . .

. . . a hole in your bicycle tyre . . . a slow puncture for instance. Wouldn't it be handy if you could fit a gadget to the valve which will pump up your tyre and keep it at pressure without extra effort? The construction of an automatic cycle tyre inflator which pumps as you pedal is described in the December *Home Mechanics*, from all booksellers, 1s. 3d.

Also in this issue; a jig for the speedy production of mortises and dowels, a new column for motorists, a "talking machine" which says thank you when a penny is inserted, and pages of make-it-yourself ideas for Christmas.

If you have any difficulty in getting a copy, *Home Mechanics* is also available from the Sales Dept, 19-20 Noel Street, London, W1, 1s. 7d., post free.

BOOK REVIEW

The Tramways of Reading, by H. E. Jordan. (London: The Light Railway Transport League). Price 14s. 6d.

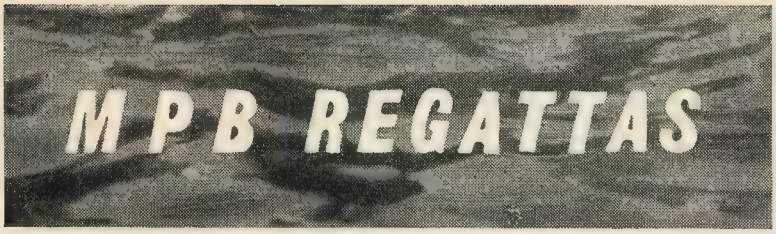
MANY years ago the tramways men in Reading used to see a little boy running through the streets with sandwiches and tea or cocoa for his father, who spent forty years in the local transport service as conductor, motorman, trolley-bus driver and inspector.

"Young Tim," became so well steeped in the tramways life that he could swing a can full of tea over his head in the approved style; though this was an inadvisable performance if mother happened to be looking!

The last tram, No 13, ran out of Broad Street at 11.30 on Saturday night, 20 May 1939, and now, eighteen years later, Young Tim pays his own intimate tribute to the cars and the men who worked them through 36 years of war and peace.

Much patient and pleasant research among local papers, committee minutes, books and maps has gone into *The Tramways of Reading*, but the history owes its best qualities, as well as its origin, to the memories of boyhood.

There is a good deal in these 93 pages for the tramlover and a good deal else whose interest for the individual reader depends upon the degree of his enthusiasm. Less grubbing in files and more of Young Tim's memories would have given *The Tramways of Reading* a wider appeal and brought the dead facts alive. But at least the facts are here, and many will be grateful for Mr Jordan's labour of love even if he has laboured only too well.—J.M.



PARIS INTERNATIONAL

It was top marks to France in this top-line contest

By G. M. SUZOR

WITH competitors from four nations—Britain, France, Belgium and Italy—taking part, the most important international power boat regatta yet held on the Continent was staged recently by Paris MYCP.

Much of the British interest was centred on Ken Hyder. But Ken, unfortunately, was not able at any time to find the correct adjustments to maintain the high speeds he has attained on home waters. He tried several carburation settings, but failed to be classified in the Hispano Suiza Cup. Not all was lost to him, as he finally managed to secure second place in the Diele Cup—with a speed he has never reached in England.

However, this record was shortly afterwards shattered by Jean Menant, of France, whose *Spido* attained the extraordinary speed of 81.038 m.p.h. M. Ostroska's boat, powered by a home-made engine, reached 79.885 m.p.h. The rest of the French team backed up admirably and France was awarded the two trophies.

Competitors with their boats

Broke its bridle

The catastrophe of the day occurred when Gems Suzor's boat *Nickie* 10 broke its bridle and disintegrated at speed. Up to that point the boat was registering the same speed as Ken Hyder's entry.

Outstanding boats included those of Italy's Marelli brothers, one of which was powered by an Italian 10 c.c. Super-Tigre engine. Both had classical shapes; the space between the pontoons was relatively narrow, forming a unit with the rest of the hull instead of being separated. An unusual-looking boat was Carlo Fontanesi's which, made from aluminium sheet, was shaped like a spindle and had two pontoons apart from the hull.

One of the most confident competitors at the regatta was young Signora Dora Fontanesi . . . she handled her boat with as much ease as a veteran at Victoria Park ! ▣

THE RESULTS

Hispano Suiza Cup

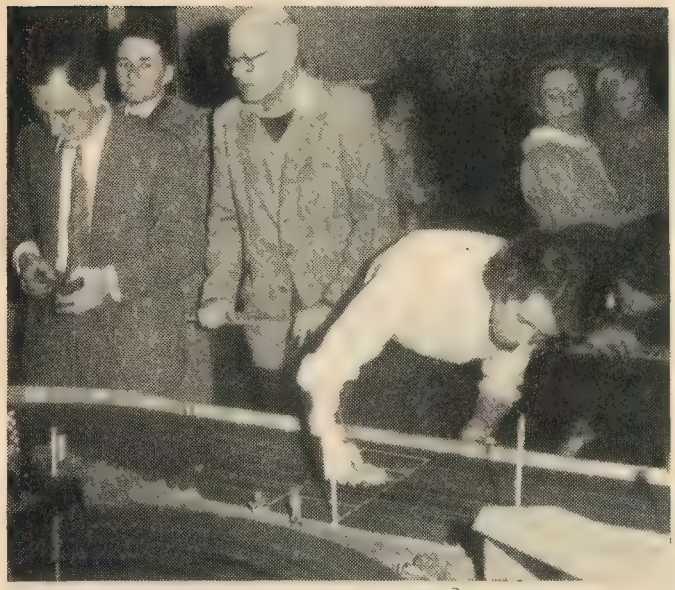
1	J. Menant	(France)	*Spido*	81.038 m.p.h.
2	M. Ostroska	,,	*Dolphin 6*	78.763 ,,
3	M. Mercier	,,	*Delta 4*	73.090 ,,
4	F. Marelli	(Italy)	—	70.345 ,,
5	E. Marelli	,,	—	69.040 ,,
6	Sgra D. Fontanesi	,,	—	67.368 ,,
6	M. Grenier	(France)	*Trident*	67.368 ,,
8	C. Fontanesi	(Italy)	—	65.023 ,,
9	M. Vanhoye	(Belgium)	*Scorpion*	53.007 ,,

Diele Cup

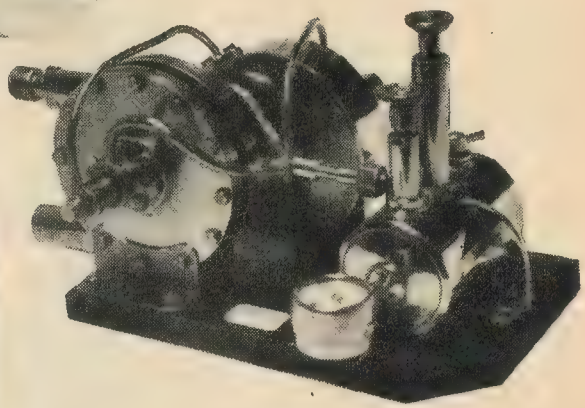
1	M. Ostroska	(France)	*Dolphin 6*	79.885 m.p.h.
2	K. Hyder	(England)	*Slipper 5*	78.763 ,,
3	C. Fontanesi	(Italy)	—	74.564 ,,
4	M. Grenier	(France)	*Trident*	74.073 ,,
5	Sgra D. Fontanesi	(Italy)	—	69.904 ,,
6	E. Marelli	,,	—	69.462 ,,
7	F. Halphen	(France)	*Rock 'n' Roll*	69.040 ,,
8	M. Mercier	,,	*Delta 4*	66.967 ,,
9	J. Menant	,,	*Spido*	60.443 ,,
10	F. Marelli	(Italy)	—	58.869 ,,
11	M. Vanhoye	(Belgium)	*Scorpion*	46.993 ,,

From Northerner on the Lancs

The Southport Exhibition

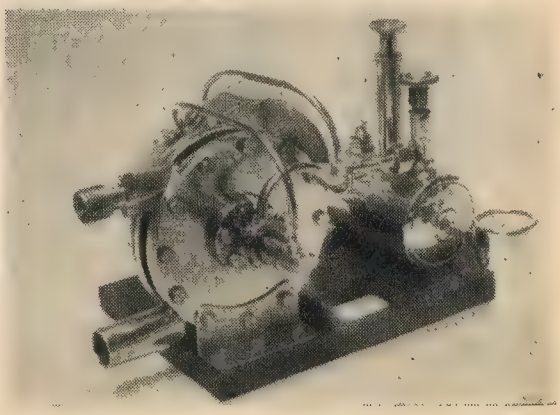


Above: This young lady, one of the Grand Prix demonstrators at the exhibition, places a Jaguar on the starting grid. (The Southport International Grand Prix was won by H. Hatley with a Vanwall, clocking a time—for 200 laps of 58 ft—of 30 min. 7.5 sec.)



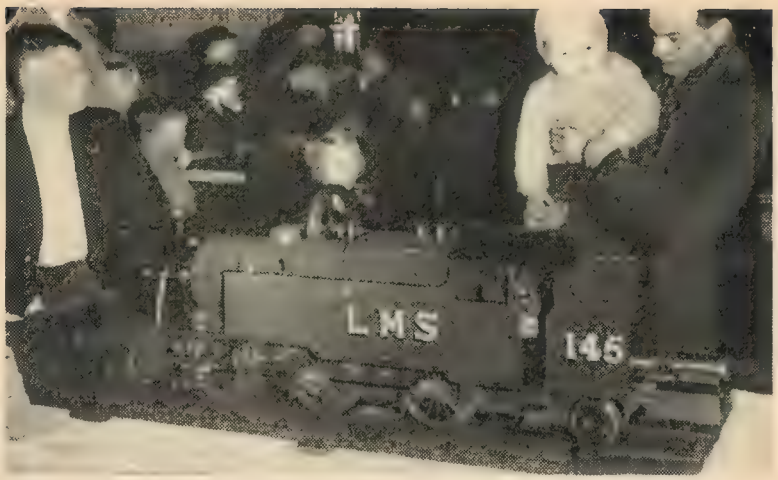
Above and below: Two views of the steam turbine built by E. Feilden, of Birkdale, complete with reduction gear. Pressure lubrication is used, with a handpump and gauge on the tank, and a screw-down valve to regulate the oil to the main and drive-shaft bearings and the gear casing

Above: A bird's eye view of Southport MEC's race track. The excited spectators are watching the finish of one of the Grand Prix preliminary heats

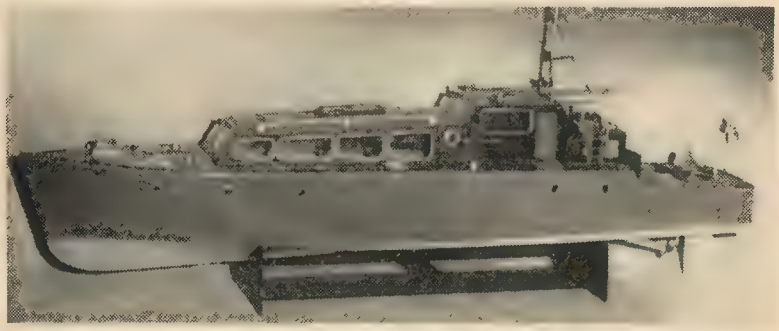


coast comes this review of

Above: This neat Bermudian sloop was exhibited by G. A. Jones, of Crosby MC. An interesting feature was the hard-chine hull which was fitted with a brass centre board



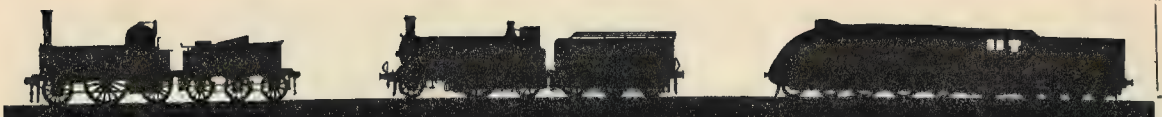
Above: Among several models lent by Sheffield SMEE was Sam Breedon's inch-scale 2-6-2 tank, which is a "doubled-up" DYAK with trailing truck added. Built several years ago, the engine's performance is still first class



Above: G. A. Jones also built this freelance recovery vessel which, on its maiden voyage, won second prize in a steering competition. The 2.46 c.c. engine has silencers made from oil tins with internal baffles, and the boat is very well detailed

Above: This 2-8-0 chassis in 2½ in. gauge is being built by W. E. Harker, of Southport. It is based largely on the LMS 8F engines and fitted with piston valves, though the valve gear will be Baker. Note the long fabricated cross stay—to prevent oscillation periods

Right: This model of a cargo liner is built to the PENANG design, only differences being the wooden (bread-and-butter) hull and metal upper works



LOCOMOTIVES I HAVE KNOWN

A quaint li

THIS drawing shows GWR engine No 3230, which, in 1920, was very well known to me.

At that date she was stationed at Didcot and worked almost exclusively on the Didcot, Newbury and Southampton line. She was then thirty years old and, as befits an engine of her small size and venerable age, she was working out her last days on light passenger duties that required no great haste or exertion. She was one of a set of six, numbered 3226 to 3231, which were of more than usual interest to locomotive historians.

The basic design dated from 1863, when Joseph Armstrong started the construction of twenty engines, known as the 111 class and completed in 1867—all at Wolverhampton.

In 1889, nearly twenty-three years later, the need for some further engines of this type arose, and William Dean simply took the original Armstrong design, gave it fluted instead of plain coupling rods, added a cab over the footplate, closed in the former open splashers and provided the then standard Wolverhampton boiler; he then ordered six engines to embody his modifications, and so the 3226 class came into being. They were the last tender engines to be built at Wolverhampton.

At first all six engines, like the 111 class, were in the Northern Division; but later they drifted Londonwards, and, in course of time, I made the acquaintance of all six. This would have been about 1911.

By 1919 four had been scrapped, leaving only Nos 3230 and 3231 in service. The latter was then in the Shrewsbury area and could rarely, if ever, be seen south of Birmingham. She outlasted her sister by five months, being withdrawn in September 1922.

When stationed at Didcot 3230 at first was engaged in working stopping passenger trains between there and Reading or Oxford. But soon she settled down to the Didcot-Newbury-Winchester trains, confining her activities to the western side of the Didcot-Newbury-Reading triangle.

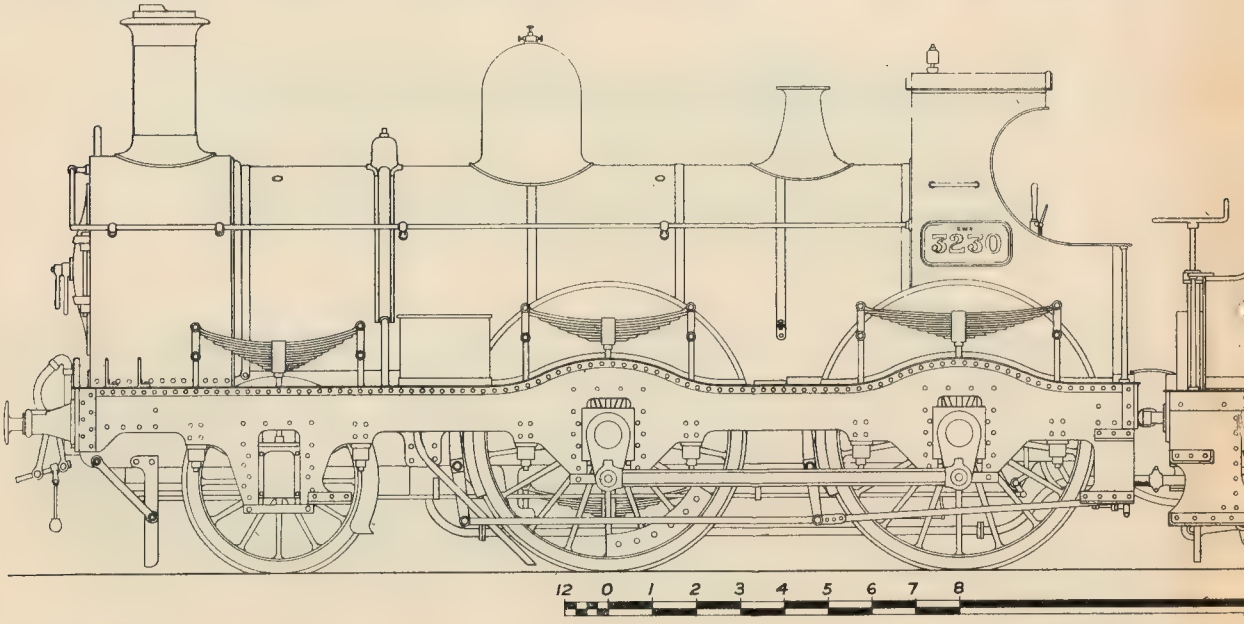
She was a quaint little object and I had a great affection for her. One of her drivers, with whom I was on speaking terms, was a fine old chap who also seemed to be very fond of her; but the young fireman obviously regarded her with a kind of amused tolerance, looking forward to the time when he would, as he thought, fire something better. Of course, he may be driving the Bristolian today !

The general dimensions of the 3226 class engines were: cylinders, 17 in. dia. and 24 in. stroke; leading wheels, 4 ft 1½ in. dia., coupled wheels, 6 ft 2 in. dia. The total wheelbase, according to the official diagrams, was 15 ft 6 in., divided into 7 ft 5½ in. plus 8 ft ½ in.; overhangs, 4 ft 6 in. in front and 4 ft at the back.

The boiler particulars that follow are based on probability, because there does not appear to have been an official diagram made for an engine of this class as fitted with a boiler of the type shown in my drawing.

The only certain information I can give is that 3230 acquired the boiler in April 1915, and it was of Swindon design and build. I surmise, therefore, that it was one of a batch of about thirty built between 1904 and 1909 for use on some of the smaller and older types of engines, in which case the following particulars would apply:

The barrel was made in two rings, the larger (back) one of which was 4 ft 3 in. dia. and had the dome



Number 47
By J. N. Maskelyne

ttle 2-4-0 GWR engine

mounted on it; the length of the barrel was 10 ft 10 in., and its pitch was 6 ft 10 in. There were 243 tubes of 1⅝ in. dia. and the working pressure was 150 p.s.i.

The firebox was 4 ft 8 1/16 in. long, 3 ft 8 in. wide and 5 ft 7⅜ in. high, and the grate area was 15.62 sq. ft. The tube heating surface was 1,147.87 sq. ft, and that of the firebox was 99.4 sq. ft, making the total 1,247.27 sq. ft. An added point of interest is that top-feed was fitted, as shown; this was not usual on these boilers.

The normal tenders for these engines were of 2,500-gallon type; but, for some reason or other, 3230 had one of the very small 2,000-gallon tenders. The weight of this engine was about 36 tons, of which some 24½ tons rested on the coupled wheels. The tender, full, weighed 24 tons.

Other engines of this class that I often saw prior to 1915 were 3226, 3228 and 3231. The first of these was often to be seen at Didcot, though I believe she was actually stationed at Swindon. At that time she carried a boiler of similar type to the one on 3230—although the chimney appeared to be slightly longer and had no smoke deflector. Her tender was larger and longer, being of the 2,500-gallon type.

No 3228, when I first met her in 1910, was really the gem of the series; her boiler was of the Wolverhampton pattern, having a raised round-top firebox, and fitted with an extended smokebox on which was mounted a short chimney with a smoke deflector. Her boiler barrel appeared to be made in two rings, with a tall dome set at the back end of the front ring.

Her tender was an old one of the Gooch slotted, sandwich-frame type, possibly from an old goods engine that had been scrapped some years before. It had not then had the coal rails replaced by a raised coalplate.

A year or two later, about 1912, I met 3228 again, and was not a little amused to see that her appearance was much altered, for she now had a boiler with a Belpaire firebox and with the dome on the back ring. She still had her old tender, but the coal rails had gone and a raised coalplate had been put on instead.

No 3231 was often to be seen at Birmingham Snow Hill Station, when I was temporarily stationed there in 1920. She had a Wolverhampton boiler similar to the one that 3228 formerly carried. Her tender was of the Dean 2,500-gallon type at that time. Nos 3227 and 3229, so far as I can recall, were similar to 3230 in general appearance, except for larger tenders.

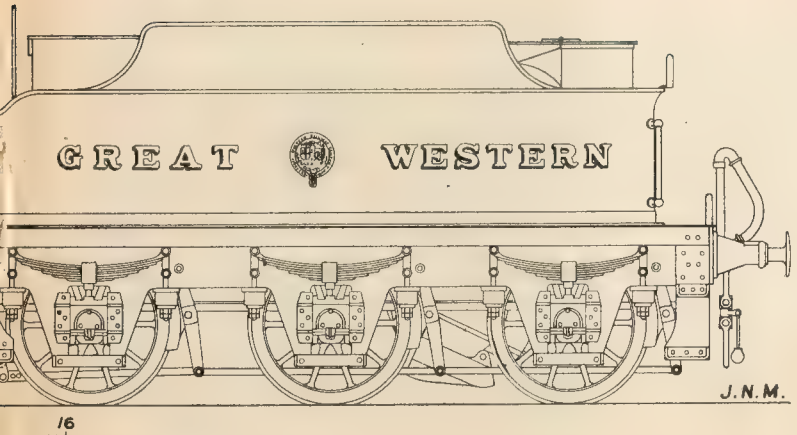
These fascinating little engines may have seemed small, but they were quite powerful for their size; with 150 p.s.i. pressure in the boiler, the official tractive effort figure was 11,950 lb. I never saw one on a really heavy train, but, except when working goods trains, they generally gave the impression of being in a hurry, which was always rather amusing to watch.

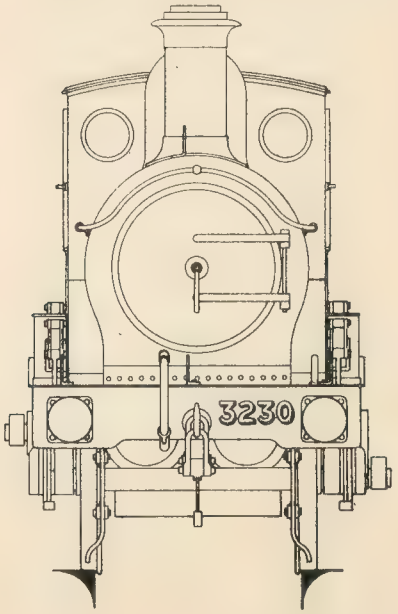
Outside coupling rods, at one time so commonly seen on the GWR, were a never-ending source of interest to me—and this, together with the almost infinite variety of detail changes to be noted, probably accounted for my fondness for so many of the older GWR locomotives.

At any rate, by that time I had become a confirmed enthusiast for the creations of Dean and Churchward. But of all the GWR engines, 3230 is one of my outstanding memories.

Her small tender was of interest, in that it was one of those designed by William Dean for the Duke-class 4-4-0s in 1895. Its small size was necessary because in Devon and Cornwall the existing turntables were not long enough to take engines fitted with the larger sizes of tender.

The same restrictions applied in later years to other localities, especially in Wales and on some cross-country connecting routes nearer London. The result was that this small type of tender, with its 11-ft equally-divided wheelbase, was attached to certain engines of the Armstrong and Dean 0-6-0 types, Dukes, Bulldogs and some 2-4-0s. ▣





ROSE

LBSC now describes a suitable smokebox for the coal-fired boiler of this simple locomotive and follows on with instructions for the tender

Continued from 14 November 1957, pages 676 to 678

THE water-tube boiler did not require a separate smokebox as the casing was made long enough to include it, but this cannot be done with the coal-fired boiler, and so a separate smokebox will be needed. However, this doesn't entail much extra work—and by utilising the same arrangement as specified for the front end of the water-tube casing, the job will present no difficulties for the beginner.

The barrel of the smokebox is a piece of 2½ in. × 18-gauge brass or steel tube faced off at each end in the lathe to a length of 1½ in. If tube isn't available roll it from 18-gauge steel, with about $\frac{3}{16}$ in. overlap, and braze the joint, or use the same thickness in brass and silver solder it. The chimney liner is exactly the same as specified for the water-tube boiler, and is fitted in the same way, the holes for the blast pipe and steam pipe being drilled as previously described.

The wrapper is bent up from 16-gauge sheet steel or brass as on the water-tube boiler, but after fitting it to the barrel and securing it with a couple of countersunk screws at each side—at the places where it parts company with the barrel—fill up the space at the back with a piece of sheet steel or brass, bent over at each side to form flanges which are riveted to the wrapper, like the throatplate of the water-tube casing.

The upper edge is cut to fit the radius of the barrel. The front of the smokebox is a casting with a dummy door and adornments cast on (as with the water-tube front), the spigot being turned to a tight push fit in the barrel and the edge being filed to fit nicely in the recess between the barrel and the wrapper. When fitting this be sure to have it about right, for if there are any air leaks the boiler won't steam.

The smokebox is attached to the boiler by a ring which can be bent up from a $\frac{3}{8}$ in. strip of 16-gauge steel or brass. Fit this by trial-and-error, with butted (not overlapped) ends. When the ring fits very tightly in the barrel, with the ends touching, adjust it so that $\frac{3}{16}$ in. projects all around, then put four $\frac{1}{16}$ in. rivets through the barrel and ring to keep it in that position.

To fit the smokebox to the boiler, just smear some plumber's jointing around the projecting bit of ring and press it into the end of the boiler. It should need no further fixing, but if at all slack four $\frac{1}{16}$ in. countersunk screws can be put through the end of the boiler barrel and the ring. Make quite sure that the chimney liner is quite vertical before putting the screws in !

BACKHEAD FITTINGS AND ERECTION

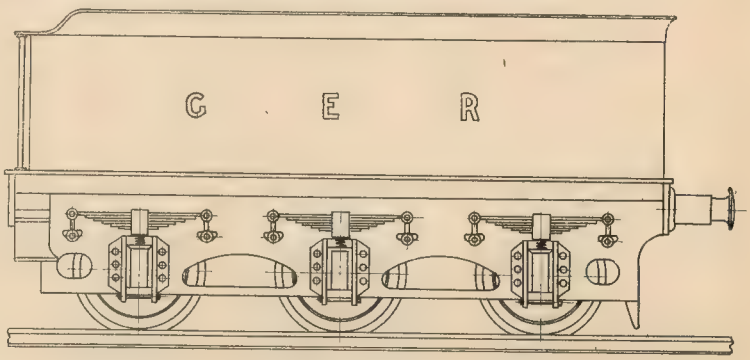
The regulator handle and blower valve are the same as on the water-tube boiler, but no feed clack is required as two of these are fitted to the bushes at the smokebox end of the barrel. Owing to the presence of a firehole door, the water gauge will have to be fitted on the slant, the upper fitting going into the hole to the left of the regulator while the lower one is fitted in the hole to the left of the firehole. Line them up as described for the water-tube boiler and fit the glass in the same way, but note that the piece of glass tube will be $\frac{3}{16}$ in. shorter.

The firehole door is made as described for *Zoe*, but oval instead of circular, which makes no difference to the fitting. It may either be cast or built up. If any builder prefers a circular firehole and door, there is no earthly reason why he shouldn't fit it; personally, I can poke a shovel more easily into an oval hole when the engine is running.

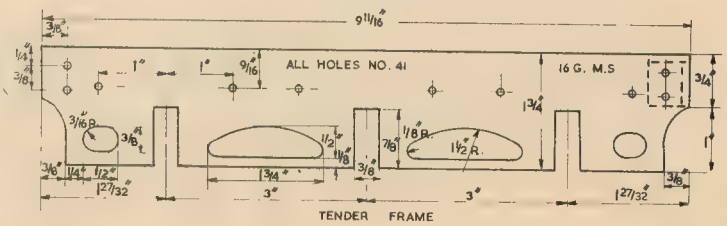
When erecting the boiler, level it up as described for the water-tube boiler and fix the smokebox end in the same way, but instead of screwing the firebox end direct to the frames, make a couple of little brackets from ¼ in. × ⅛ in. brass angle, screwing them to the sides of the firebox shell about 1¾ in. from the back end so that they rest on the upper edge of the frame. Clips bent up from 18-gauge steel can be fitted as shown, to prevent the boiler lifting when the cab is off, otherwise they are not absolutely essential and can be left off.

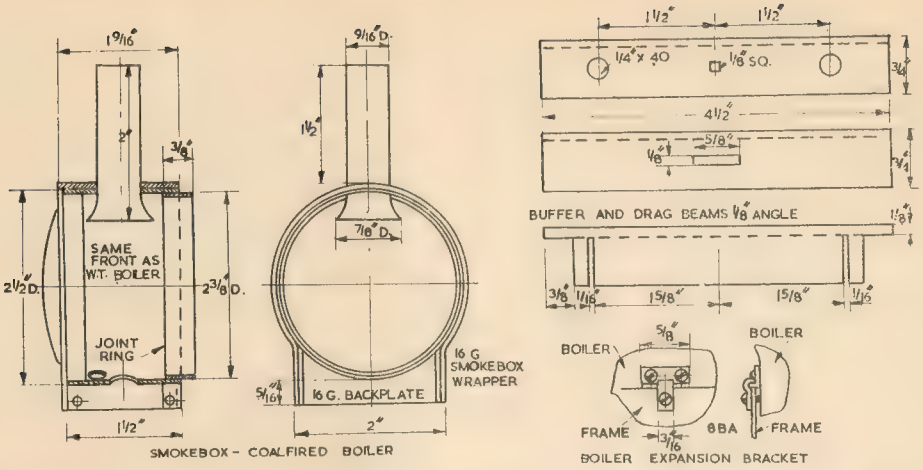
THE TENDER

To avoid delay to the good folk who are building the locomotive with the water-tube boiler I will leave the notes on fitting the grate and ashpan until the next instalment, and carry on with the tender.



G.A. OF TENDER





The tender illustrated is of the standard GER type as built for the engines of which *Rose* is representative, and is fairly correct both in size and in appearance. Nobody would mistake it for a tender belonging to any other railway ! It is easy enough to build, and will suit both the spirit-fired engine and the coal-fired variation by merely altering the internal arrangements as I will show.

If any builder prefers a straight-sided tank with the higher coal bunker, it can be fitted, and I will show the alternative. In any case no alteration whatever will be needed to the frames and running gear.

The frames may be cut from 16-gauge mild steel—the soft blue variety is the most suitable—or they may be cast with the dummy leaf springs and horncheeks integral as was done by two or three ME advertisers for the tender of my 2½ in. gauge *Austere Ada*. This saves much work as the only machining needed would be cleaning out the openings for the axleboxes. A big flat file judiciously used would do that provided the frame castings were clamped together back to back.

For plate frames, two pieces 9¾ in. long and 1¾ in. wide are required. Mark out one in the usual way, drill the screwholes at each end, use it as a jig to drill similar holes in the second plate, temporarily rivet them together, and saw and file to outline. The easiest way of cutting the big holes is to drill a round hole first (anywhere in the marked-out space), then cut the outline with one of the thin spiral-tooth files, or an Abrafile, used in an ordinary hacksaw frame. As these cut in any direction the job is a piece of cake.

The buffer and drag beams can also be cast, and so will have the fixing lugs for the frames cast on. They will need no slotting; merely clean up the outer faces of the lugs and screw the frames (whether cast or plate) directly to them. Steel or brass angle of ¾ in. × ⅛ in. section can be used as shown, two pieces of 4½ in. length being needed.

The ends can be finished off dead square by putting them together, one angle inside the other, gripping in the three-jaw and facing with a round-nose tool set crosswise in the rest. The chuck will hold them all right—try it !—and it doesn't matter about the pieces running eccentrically so long as they are axially true. I used to do them like that in the days when I had no milling machine.

The faces are drilled and slotted as described for the engine, so no repetition is needed. The tops are cut away and slotted for the frames as shown. This can be done in the lathe by gripping the two pieces top-to-top in a machine vice either regular or improvised, bolted to the saddle, and running them under a ⅛ in. saw-type milling cutter on an arbor between centres.

The full depth of slot can be cut in one operation if the lathe is run slowly, and plenty of cutting oil applied with a brush. The advantage is that both beams are exactly alike as to width, depth and distance apart of the slots, so that the frames when erected are at right angles to the beams and truly parallel.

When doing them on my milling machine in a similar way I put a toolmaker's cramp at each end to prevent the two beams springing apart when the cutter starts work.

I don't advise cutting the slots by hand, but if no means of machining them are available mark out the top of each beam and grip one in the bench vice with the marked-out slot just showing above the jaws. The angle will naturally have to be gripped at the end of the jaws, and, to ensure the slot being at right angles to the beam, set this vertically with a try square.

Next saw along the marked line, keeping the sawblade flat on the vice jaw which thus acts as a guide, and finish with a keycutter's warding file (or similar thin flat file) without removing the beam from the vice, using a piece of metal of the same gauge as employed for the frames as a gauge. It should fit tightly.

I have dilated on this job because if the slots are not accurately cut the whole frame assembly will be out of truth, and this, in turn, will throw everything else out, including the wheels and axles.

A ⅝ in. length of ⅝ in. × ⅛ in. angle is riveted to the beam against the inner side of each slot, as described for the inside frames of the engine. The frames, too, are attached to them in the same way, taking the same strict caution to level up the assembly on the lathe bed, or something equally flat and true, before putting in the screws.

HORNS AND AXLEBOXES

There used to be on the market hot-pressed castings comprising a dummy leaf spring and a pair of horncheeks which were suitable for a 2½ in. gauge tender. If these are still available I recommend their use as all they need is the rubbing faces of the cheeks cleaning up with a file to allow the axleboxes to slide easily between them. The castings are then riveted to the frames over the axlebox openings, using a piece of ⅜ in. square rod to line them up, and fixing them with 1/16 in. rivets in the spaces between the ribs on the horncheeks. The spring castings, being integral, required no further fixing.

Dummy leaf spring castings of the ordinary type only need a 5/32 in. hole drilled in each hoop or buckle

to accommodate a spiral spring. They can then be attached to the frames over each axlebox opening. Take care to set them centrally. Attachment is made either by drilling right through the bosses on the hangers and the frame with a No 51 drill and using long $\frac{1}{16}$ in. rivets, or putting screws through holes in the frame into tapped holes in the hanger bosses (see drawing).

The location of the holes shown in the frame drawing were taken from the cast dummy leaf springs fitted to some of my 2½ in. gauge tenders (I still have a few castings left) but can be varied to suit any size of spring casting that the builder may have available.

Separate cast horncheeks may be used, and will only need cleaning up on the rubbing faces. Horncheeks may also be made from 1 in. lengths of $\frac{1}{4}$ in. × $\frac{1}{16}$ in. angle as illustrated. Round off one end and drill a No 51 hole in it for the bolt-type hornstay. Bevel off the other side as shown, and drill three No 51 holes in it for the rivets holding it to the frame.

Erect with the upper-end level with the top of the axlebox opening and the rounded-off end projecting below the frame as shown in the general arrangement, using $\frac{1}{16}$ in. rivets. Put a piece of $\frac{3}{8}$ in. square rod in the opening and hold the horncheek up to it with a toolmaker's cramp over cheek and frame, while putting the first two rivets in. Cast cheeks can be attached in the same way.

If castings aren't available for the axleboxes make them from $\frac{1}{2}$ in. × $\frac{7}{16}$ in. gunmetal or hard brass bar, a piece about 4½ in. long being required. Mill a rebate along each shorter side as described for the engine axleboxes, clamping the piece under the slide-rest toolholder and traversing it across a $\frac{3}{8}$ in. or larger endmill or home-made slot drill in the three-jaw. If the lathe hasn't sufficient travel on the cross slide to do the whole length at one operation, cut the piece in half. After milling, either part off six $\frac{5}{8}$ in. lengths in the four-jaw or saw off the lengths to full dimension, and face them off to the correct length in the chuck.

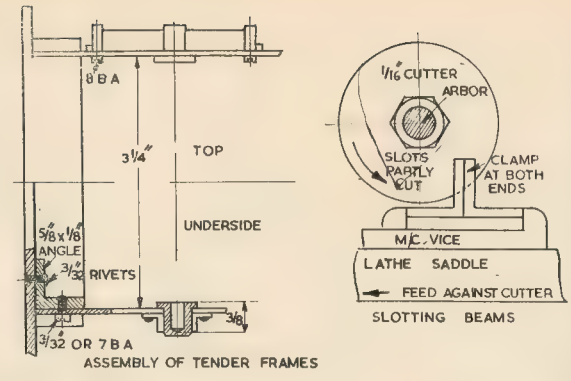
The boxes can be made without milling by a method I described over 30 years ago. Part off six $\frac{5}{8}$ in. lengths of $\frac{3}{8}$ in. square rod for the boxes and attach the flanges made from pieces of $\frac{1}{16}$ in. sheet brass, $\frac{1}{2}$ in. wide and $\frac{5}{8}$ in. long, riveted and soldered on. I used them on my 2½ in. gauge 4-4-0 *Simple Sally*.

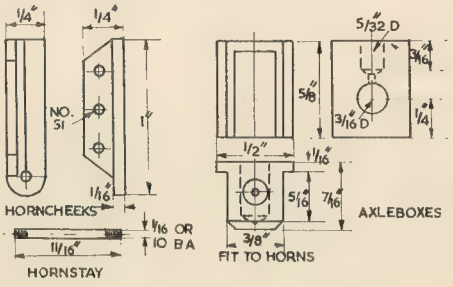
The hole for the journal is drilled $\frac{1}{4}$ in. from the bottom of each box—take great care to have it central—and put a $\frac{3}{16}$ in. drill in to $\frac{3}{8}$ in. depth (see section). On the centre line of the top of each box, at $\frac{3}{16}$ in. from the edge of the flange, drill a 5/32 in. hole $\frac{3}{16}$ in. deep for the spring, and from the bottom of this drill a $\frac{1}{16}$ in. hole through into the journal hole for oiling purposes. Thus the spring pocket also serves as an oil cup !

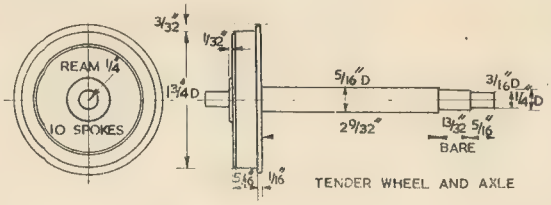
The front faces of the boxes can be bevelled off with a file as shown for appearance' sake, or can be finished off in any other fashion that may suit the builder of the engine. The springs can be wound up from 20-gauge tinned steel wire, and should just start to compress when the axleboxes are at the bottom of the slots. They can't jump out when running over a rough road, the lower part being in the pocket in the axlebox and the upper part in the hole in the hoop of the casting.

The axleboxes are prevented from falling out when the tender is lifted by hornstays made from $\frac{11}{16}$ in. lengths of $\frac{1}{16}$ in. silver steel, screwed both ends either $\frac{1}{16}$ in. or 10 BA, put through the holes at the bottom of the horncheeks and secured with commercial nuts.

Now for the easiest way to assemble and erect the whole issue: lay the frame upside down on the bench, put the springs in the holes in the hoops, with an axlebox on each journal, and drop them into place with the axleboxes between the horncheeks and then put the hornstays in and nut up. But before embarking on that enterprise the wheels and axles must be turned and fitted.







WHEELS AND AXLES

The wheels are the same size as the leading wheels of the engine—1¾ in. dia. on the tread with 3/32 in. flanges. They are machined in exactly the same way, but the bosses only project a bare 1/32 in. from the face of the rims as they have to fit between the flanges of the axleboxes when erected.

The axles are turned from $\frac{5}{16}$ in. round mild steel, three pieces each 3¾ in. long being needed. If the three-jaw is reasonably true the journals and wheel seats can be turned at the same setting, and then they must of necessity be true with each other. If the chuck is badly out of truth turn the axles between centres. First take a skim off the end to true it up, then turn $\frac{5}{16}$ in. length to $\frac{3}{16}$ in. dia. an easy fit for the hole in the axlebox, which can be used as a gauge. Turn the next 13/32 in. (bare) to a press fit in the wheel boss.

Now I certainly don't advocate turning wheel seats taper. The smallest amount of side movement that develops would loosen the whole lot. Fit them just as I describe fitting the combining cone of an injector. With a $\frac{1}{4}$ in. taper broach take a very tiny scrape out of the end of the reamed hole in the boss of the wheel, entering the broach from the back. The scrape shouldn't exceed $\frac{1}{8}$ in. in depth. Turn the wheel seat so that it just—*and only just*—enters the scraped end of the hole. It should then be a perfect press fit in the unscraped part of the hole.

● *Continued on page 752*

Do not forget the query coupon on the last page of this issue

READERS' QUERIES

This free advice service is open to all readers. Queries must be on subjects within the scope of this journal. The replies published are extracts from fuller replies sent through the post: queries must not be sent with any other communications: valuations of models, or advice on selling, cannot be given: stamped addressed envelope and query coupon with each query. Mark envelope "Query," Model Engineer, 19-20 Noel Street, London, W1.

Gear layout

I am building a 3½ in. gauge locomotive using *P. V. Baker* cylinders but *Netta* wheels, etc. Can you tell me how the radius of the expansion link for Walschaert's valve gear is arrived at, and also the length of slot required ? I have set out my valve gear using pieces of card and find that with a link radius of 2⅞ in. I can only obtain even port openings in forward gear. —A.H., London, W14.

▲ *In laying out Walschaert's valve gear, the position of the pivot of the expansion link should be determined first, bearing in mind that the radius rod is connected above the valve crosshead when piston valves are used. This position should be roughly halfway between the valve crosshead and the main axle centre—in a horizontal plane. In a vertical plane it should be in line with the point of attachment of the radius rod to the combination lever.*

Thus it follows that the radius of the expansion link is equal to the distance between this pivot and the point of attachment of the radius rod to the combination lever. The exact length of the expansion link is not critical; it is the proportion of it that counts. It should be such that the expansion link swings about 20 deg. to 25 deg. either side of its vertical centre line

Without having further information it is not easy to say where the error lies. However, lay the gear out on paper at least twice full size and, employing a pair of dividers, the error should be clearly seen.

The exact link radius could only affect the timing if it does not match the radius rod used with it, as mentioned.

Clarifying Maisie

I have a set of drawings and LBSC's "words and music" for the 3½ in. gauge *Maisie*, but there are a couple of points on which I am not quite clear. I have completed all motion parts, steam chests, cylinders, etc., and do not want to risk assembling and then finding the valve setting wrong. The points on which I am uncertain are:

1 Would I be correct in assuming that as the forward gear eccentric is shown nearest the frame on the right-hand side (from cab end) this would equally apply on the left-hand side ?

2 Should the back gear eccentric be set to the *front port* as for the forward gear (on the same cylinder), the wheels and eccentric naturally being turned backwards and the reverse lever pulled back to the reverse position ? —J.E., Osterley, Middx.

▲ *On the 3½ in. gauge locomotive* MAISIE, *the forward gear eccentric is normally nearest to the frame on that side of the locomotive. On valve setting the reverse lever should be put in full forward gear and the valve adjusted on its spindle to give equal port openings at each end. Next the forward gear eccentric should be put roughly 90 deg. in advance of the crankpin which should be put at front dead centre (the lever still in full forward gear).*

The forward gear eccentric should now be shifted gradually forward until the front port shows as a black line (about 0.010 in.) and tightened. Turning should be continued in a forward direction until the crankpin is at back dead centre. The back port should now be cracking as a black line. If so, the setting is correct. Next put the lever in full backward gear, turn the wheels backwards until the back dead centre is reached. Put back the eccentric roughly 90 deg. in advance of the crankpin as before, then shift it gradually in the reverse direction (i.e. to give it more advance over its crankpin) until the black line is again seen, and then tighten the eccentric.

Finally, continue turning the wheels in the backward direction until front dead centre is reached, when the port should again show as a black line. If it does not, the valve is too long and must be shortened so that the cavity is still in the middle of the valve.

Shop window turntable

I wish to construct a revolving window display stand. These stands usually consist of turntables of about 18 in. dia., suitably equipped, and they are powered by an electric motor giving a final speed of about 1 r.p.m.

I should be pleased to learn the type of motor used and any possible suppliers, also the method of drive, e.g. whether through reduction gears or friction drive on rim of turntable. —H.C.M., Dinas Powis, Glam.

▲ *Some of these stands are equipped with synchronous motors which give a relatively low speed and can thus be used with very simple reduction gear. But as to the suppliers of suitable motors, no information is available.*

It is, however, possible to obtain small a.c. motors, of the type used for tape recorders, which run at about 1,425 r.p.m. These would require a high degree of reduction which could best be obtained by worm gearing, though the final drive can be by friction on the rim of the turntable, thus eliminating noise and shock.

Driving car dynamo

I am planning a steam power plant, using a Stuart G5 boiler and a Stuart Sirius engine. This engine develops 0.4 b.h.p. at 2,800 r.p.m.

It is my intention to drive a 12 v. car dynamo, and I would be glad if you would assist me on dynamo performance. According to theoretical calculations, 0.4 b.h.p. = 298 w. This would indicate that the engine will drive a 12 v. dynamo, and a load of 20 amp + could be used.

There will be some mechanical loss in turning the dynamo—this, of course, is only demonstrable under actual working conditions.

Do you consider it reasonable to say that (a) I could draw 20 amp. from this dynamo, and (b) would the engine at 2,800 r.p.m. be fast enough to enable this current to be produced, as then it could be direct coupled to the engine ? Or would a faster speed be necessary ?—E.H., Littleborough, Lancs.

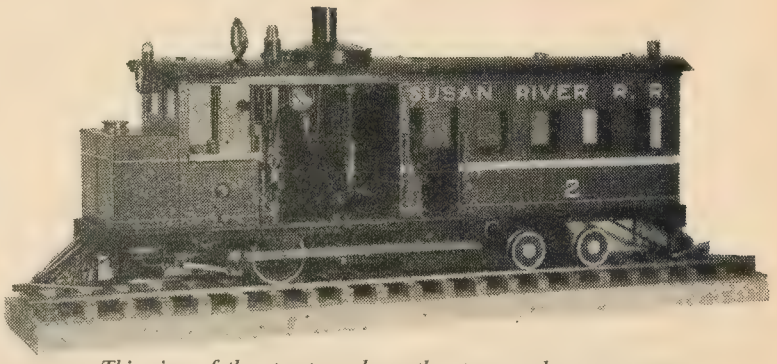
▲ *It is doubtful whether you could obtain the electrical output suggested with the use of a Stuart Sirius engine for driving a 12 v. car dynamo. Nearly all small generators are of relatively low electrical efficiency and in car dynamos the particular method of voltage regulation by the use of the third brush tends to lower efficiency still further.*

The dynamo output can be increased by reverting to the normal two-brush arrangement, but whether this actually increases electrical efficiency is another matter. In view of the specialised type of design it is probable that 12 amp. at 12 v. would be nearer to the maximum figure, though, of course, it is possible to increase the pressure and put up the performance of the engine to a certain extent.

Most car dynamos will work fairly efficiently at 2,800 r.p.m.

A 2½ in. GAUGE STEAM STREETCAR

A novel model which fulfilled a desire for reader Verne Carne, of California



This view of the streetcar shows the steam and water gauges and also one cylinder, connecting rod and gearing articulations

THE accompanying pictures are of a small steam streetcar or "dummy," as any small locomotive with the boiler enclosed in the cab was called, which I built in about six months.

The idea for the model came from a picture of a similar small locomotive that went into service between Pomona and North Pomona, California, a distance of about four miles, in 1888. No data were available on this little engine except this bit of information and the one picture. Therefore, this is not to be considered a scale model, although the general arrangement of parts is the same.

In fact, the model is probably somewhat larger all around than a half-inch scale model of the prototype would be, as it was considered necessary to take some liberties with the design in the interest of having a successful working model from the standpoint of boiler capacity, fuel tank capacity, etc. I also made some changes in minor details, such as the position of the headlights and the addition of pilots to suit my own taste.

Several aims

I had several objectives in mind which were served by building this model. I have always been rather partial to these little engines, and this one, an unusual type, had certain advantages for modelling, especially because of the accessibility of controls made possible by the "air-conditioned" cab.

I also had a small two-cylinder engine with loose-eccentric valve gear, the remains of an unsuccessful attempt at an O gauge engine I built several years ago, which seemed well-suited to a project such as this.

My own criteria for a successful model in this case were: (1) ease and low cost of building; (2) ease of maintenance and accessibility of parts for maintenance; (3) trouble-free running —no fragile parts to get out of order, minimum adjustments, stops for fuel and water necessary only at infrequent intervals; (4) ease of operation, especially without removing the roof.

ENGINE

The cylinders have a bore of $\frac{3}{8}$ in. and a stroke of $\frac{1}{2}$ in. The engine was originally built for a conventional locomotive, and several alterations were necessary to adapt it to the "dummy." This was done, first, by cutting off the frames in front of the cylinders and behind the drivers and silver soldering new end-pieces to the frames. The drivers were removed and crank discs substituted.

A 36-tooth, 48-pitch spur gear was used for the crank disc on one side, and this meshes with a 66-tooth gear on the driving axle. The steam and exhaust pipes were bent down parallel with the frame and flanged fittings were silver soldered on. These flanges are bolted to corresponding flanges which go through the floor of the cab, and from there the pipes go to the throttle valve and blast pipe. The engine is secured to the floor of the cab by four bolts, making it easily removable as a unit.

Upon re-examining the engine, I discovered that my standards of workmanship had improved somewhat in the last few years, and a couple of evenings were spent in making new bearings and taking the lost motion out of the valve gear. I discovered also that it would be desirable to alter the eccentrics so that they could be given some angular advance.

The eccentrics had been made with bosses with slots cut in them, with the usual axle pins working in the slots. The slots had been cut so deep that, in running, the eccentrics were 90 deg. from the crankpins, giving late admission and late cut-off. The problem was solved by putting an adjusting screw through each side of the eccentric boss, to bear against the axle pin.

By adjusting the screws, it was easy to give the eccentrics the proper amount of advance for early admission and early cut-off. This proved to be a happy solution, since the valves can be easily set, or the setting changed at any subsequent time, by merely adjusting the screws.

The screws also compensate for any error in the location of the axle pins or the depth of the slots, and the eccentrics never have to be removed for adjustment.

BOILER

The failure of the original O gauge engine was due primarily to lack of boiler capacity. I considered the next logical move to see if I could make a boiler consistent with the size of the proposed locomotive that would furnish ample steam.

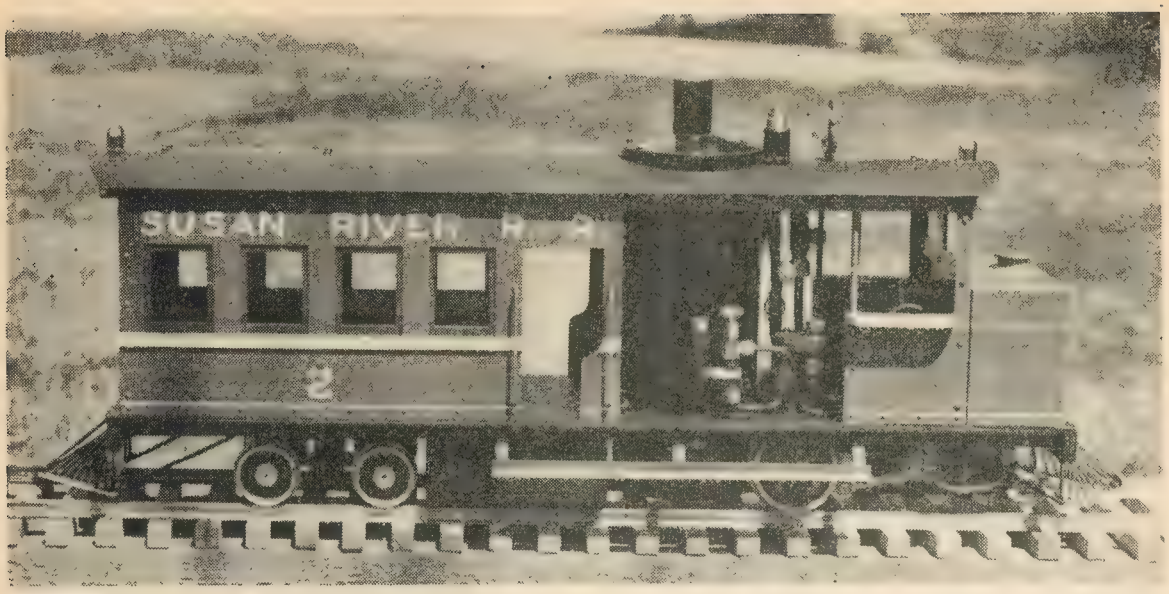
The boiler is of the conventional fire-tube type, 5 in. high × $2\frac{9}{16}$ in. dia. It was fitted with 17 $\frac{5}{16}$ in. copper flues $3\frac{1}{8}$ in. long, as well as a separator collecting pipe.

After some experimenting, I decided that firing with a vaporising gasoline burner had more advantages than any other means for a small model. The cost of fuel is negligible, much less than the cost of alcohol. There is no danger of fuel spilling and starting a fire in case of derailment and, once started, the burner requires practically no attention.

The burner is $1\frac{1}{2}$ in. dia. and furnishes plenty of heat, requiring not more than two minutes to fire up from cold water to the blow-off pressure of 80 lb. The burner is shielded from the wind on all sides, receiving all its air from the bottom.

FITTINGS

The fittings I at first considered minimum essentials were steam gauge, water gauge, safety valve, throttle



valve, boiler check valve, and drain plug. Before the job was finished, however, I had to add a few more to the list.

The first was the blower. I had hoped, in the interest of simplicity, to do without a blower and let the fire burn on natural draught. However, the fire burned poorly and I had to fit one after all. The blower pipe is merely cut into the exhaust pipe, and while it is probably not an efficient blower, it takes very little steam since the draught necessary for a gasoline burner is small.

I also had to add a blow-down valve for the water gauge, as the small glass was inclined to fill with bubbles, and I was afraid the boiler might run dry because of the difficulty of getting a true reading.

Another difficulty became evident when the engine was first tried out with its new boiler. The exhaust was directed up the smokestack in the usual manner, and while I object to water squirting up the smokestack when the engine is first run, I thought I would put up with that bad feature, since this was to be as simple a model as possible. However, with the vertical boiler the water promptly fell down through the fire tubes and put out the fire.

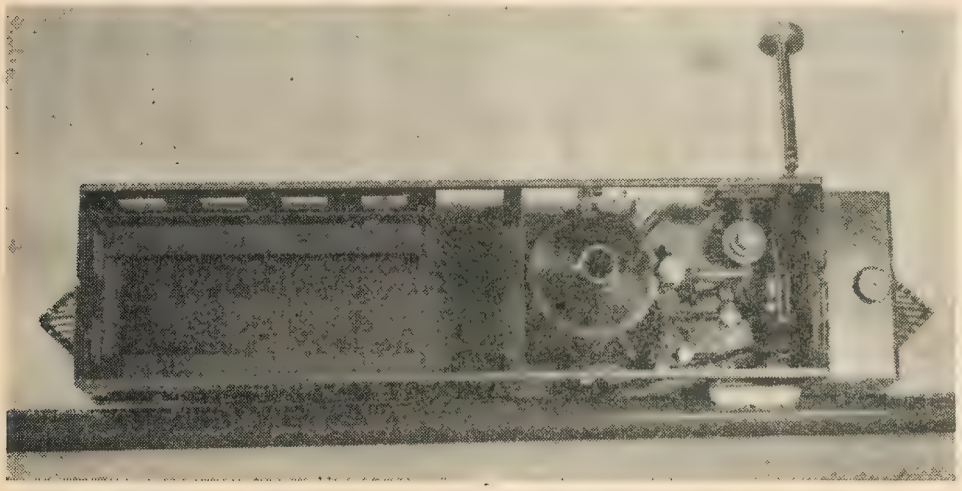
I got around this by putting a three-way plug cock in the exhaust pipe. With the cock handle turned down, the exhaust is directed downward to the centre of the track. After the cylinders are warmed up, the handle can be turned up, allowing the exhaust to go up the stack.

Lubrication is by means of a displacement lubricator in the cab. This was easy to make and provides plenty of oil for the engine. Although the steam is not superheated, I consider a lubricator of some kind a must.

A snifting valve was installed also in the main steam pipe in the cab, not because it was considered absolutely essential, but because it was so easy to fit. A tyre valve was also cut into the exhaust pipe so that an ordinary tyre pump could be used in firing up.

PUMPS

Both hand pump and eccentric pump are considered essential, even for a small locomotive, and especially for one with a boiler of small water



Top: This shot of the other side clearly shows the fine accessibility of the engine fittings

Left: Showing how the pump handle extension is fitted

capacity. The hand pump provides the most convenient means of filling the boiler and is always available in case of emergency. The eccentric pump is the simplest means of keeping the water level in the boiler somewhere near constant and, in my estimation, marks an important difference between the model and the toy. It is very annoying to have to stop running every few minutes when the water gets low, pump the boiler full with the hand pump, and then raise steam again because the boiler is full of cold water.

The pumps presented a problem because of lack of space, which will be apparent from the photographs of the locomotive.

My first thought was to put the hand pump in the tank. However, I did not want to limit the tank capacity unnecessarily and I finally decided to put it in the cab. The pump has a bore of $\frac{3}{8}$ in. and a stroke of $1\frac{1}{4}$ in., and is of the plunger type, which allowed me to place the valves advantageously. It is operated by means of a jointed extension handle which goes through the side of the cab, as shown in the photograph of the interior.

The eccentric pump presented the same problem, with the boiler close to the driving axle and the engine on the opposite side. The pump cylinder then was placed directly over the driving axle, the eccentric being made integral with the driving wheel. Both bore and stroke are $\frac{1}{4}$ in., the pump making one delivery stroke for approximately two revolutions of the engine.

The water delivered is more than adequate for ordinary running and the flow is regulated by the bypass valve near the pump.

As far as working parts are concerned, I finally came up with what I considered a minimum for a model that runs nicely, steams well, and requires little maintenance and attention while running. I did add a few details, nevertheless, for their appearance, such as pilots, headlights, plastic windows, bell, etc.

I had intended to use dummy headlights, but my children let me know that they would be very unhappy about that, and I had to work out battery-operated lights. The entire lighting system, including lights, battery cases, and switch, is located under the roof, which is easily removable.

The frame and running gear are simple, and sturdily built. The body is of 20-gauge steel, riveted and soft soldered together. The entire body can be removed by taking out 14 hex-head bolts. The floor is of $\frac{1}{16}$ in. sheet steel stiffened by side frames of T-iron, the whole being silver soldered to the buffer beams at the ends.

The locomotive is not supported on springs, but the four-wheeled truck is free to turn in any direction, giving three-point suspension to keep all wheels in contact with the rails, even on rough track.

Accessibility of parts for maintenance and running was an important consideration, and any part, with the exception of the boiler, can be removed without removing the body. Controls are easily reached, and the only occasion for even removing the roof is to attend to the lights or to fill the lubricator.

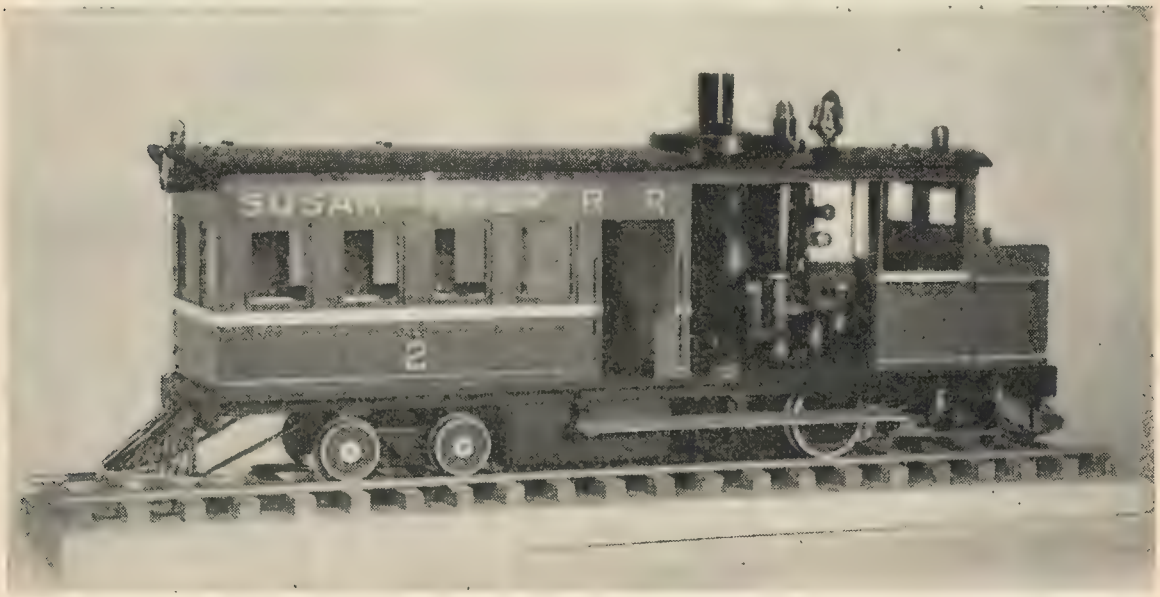
Almost the entire locomotive was built from scrap metal, either purchased at five cents a pound or salvaged from the scrap barrel behind the sheetmetal shop. The word "scrap," however, refers to the size of the pieces rather than to the quality.

I have found that it is poor economy to put a great deal of time and effort into a model made of poor material. Therefore, all bearings, cylinders, axles, etc., are made of suitable bronze, drill rod, etc.

All parts were fabricated, silver solder being used wherever parts were to be subjected to any great heat or stress, and the only parts bought finished were the two gears and the steam gauge. The total cost for six months of pleasure was about ten dollars, most of which went for gears, steam gauge, and hexagon-head bolts.

While the building of the engine was no stupendous undertaking, it proved to be a worth-while project for me, and I am quite pleased with it. It has done all that was expected of it, and has shown itself to have more power than I had hoped for. It goes up a four per cent grade with no apparent effort, and on level track easily pulls any of the small boys in the neighbourhood.

Incidentally, the Susan River Railroad will probably not be found in any directories as yet; it has its beginning in my backyard, and the rest of it is still a dream. It was named after the river that runs through our town. ▣



RECONDITIONING A MACHINE HACKSAW

EXACTUS comes to the last mechanical operation and concludes with details of the electrical installation

BEFORE tackling the electrical side I had one more machining job to do. This was the renewing of the screw for working the vice.

A piece of $\frac{5}{8}$ in. dia. bright mild steel was faced up each end in the three-jaw to the finished length of 10 1/32 in. and centre drilled. Placing the bar between centres and driving through a carrier, an Acme thread of 6 t.p.i. was cut (Fig. 19). Owing to the thread in the block (cast with the bed) not being in perfect condition, the screw was cut to suit. When a nice run fit was achieved the screw was finished off to the dimensions in Fig. 20.

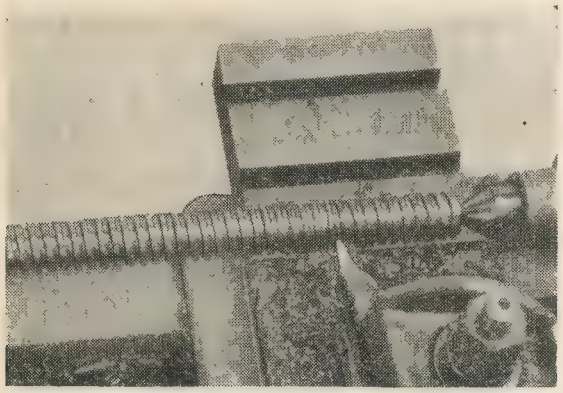


Fig. 19: *Screwcutting* 6 *t.p.i. thread*

A collar was turned from a piece of $1\frac{1}{4}$ in. dia. bright mild steel and made a press fit on the end to take the tommy bar, and when it was in position a 29/64 in. hole was drilled through. Two more collars were made from a piece of $\frac{3}{4}$ in. dia. bright mild steel and made a press fit for each end of the tommy bar.

When the screw is in position on the vice, a $\frac{1}{8}$ in. dia. silver steel retaining pin retains the vice jaw with the screw, releasing the work from the saw. The illustration in Fig. 21 shows the screw and tommy bar clamping a piece of round bar.

The motor is mounted at the rear on two brackets made from 1 in. × 1 in. × $\frac{1}{8}$ in. angle iron (the same as was used for the countershaft frame) The brackets are secured by $\frac{5}{16}$ in. × 1 in. Whitworth setscrews.

The on-off switch is another item of government surplus pressed into useful service. This switch was originally intended for an electric cooker requiring a varying degree of power. It works very satisfactorily and doesn't look out of place.

When all was fitted up and connected to the power the great moment arrived; the switch was pressed and, lo ! the motor passed its test with flying colours !

It takes time to saw large pieces of metal and one can usually occupy one's time more usefully if the saw has an automatic cut-off. Having had such experience in a large factory I decided to adapt this "short cut" to the job. I placed a small microswitch (manufactured by Burgess Products Co. Ltd) to the lower end of the prop used to hold the frame clear of the vice when not in use. A small brass case, with an insulated bottom, enclosed the switch and prevented any swarf from causing a short circuit, and the lever to operate the cut-off, when it came into contact with the switch, was bent from a piece of $\frac{3}{8}$ in. × $\frac{1}{8}$ in. bright mild steel.

The lever is set so that it comes into contact with the microswitch on completion of the cut. It will be realised that when the frame is lifted the saw will automatically come into life again unless the main switch at the side is turned to its off position. I have not found this any great disadvantage—just a matter of getting accustomed to procedure.

And so I come to the end of this

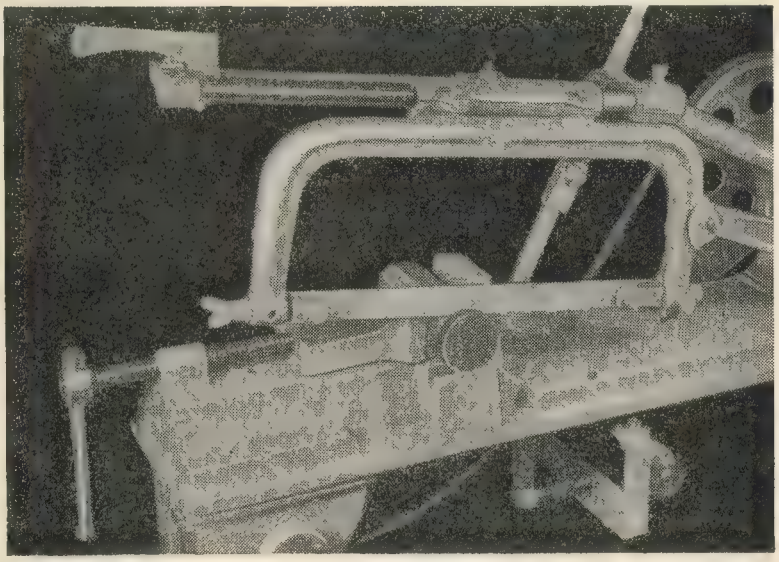


Fig. 21: *The tommy bar and screw in position on the vice*

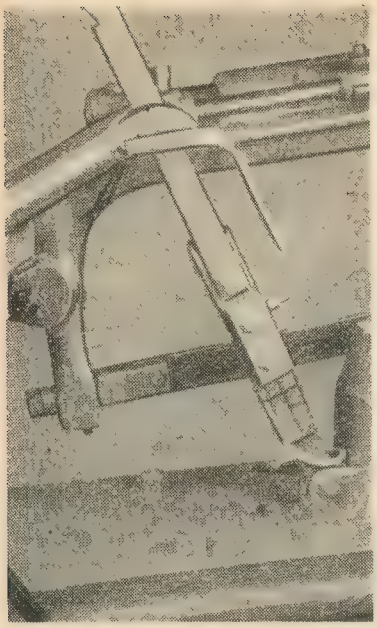


Fig. 23: The microswitch in the "on" position

description of the reconditioning of a machine saw. The completed job can be seen in Fig. 25. I haven't the slightest doubt that it will give good and faithful service. ▣

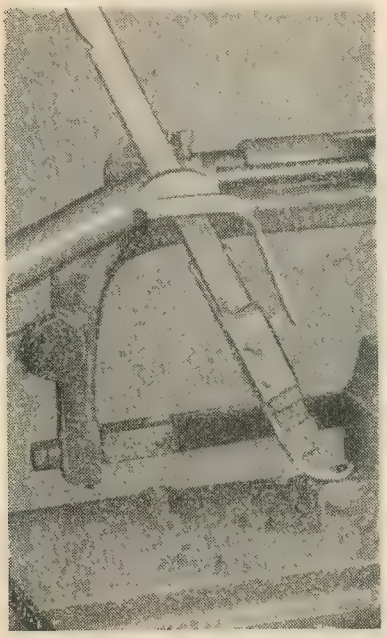


Fig. 24: The micro-switch in contact with the lever breaking the circuit

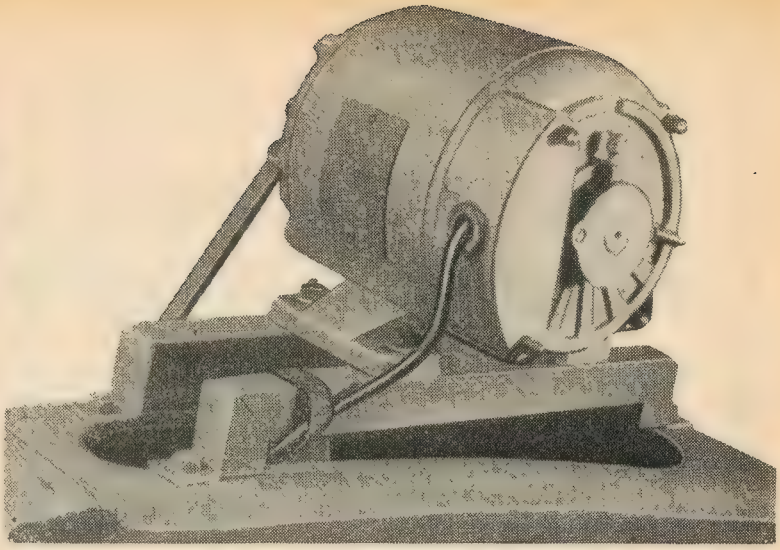
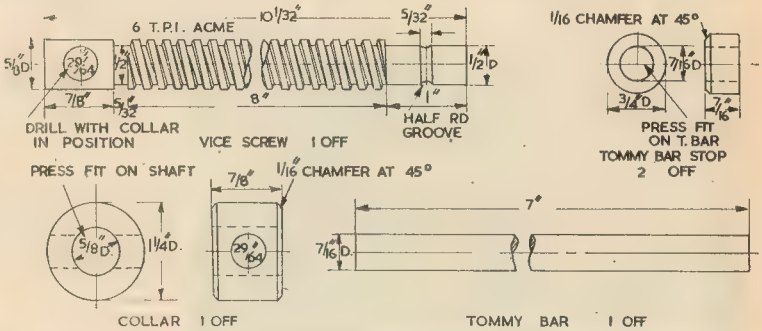


Fig. 22: ¼ h.p. Brooks motor that supplies the power



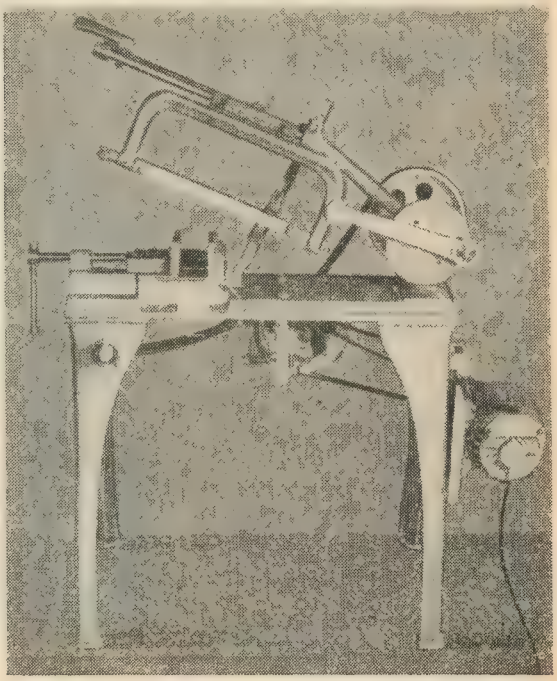


Fig. 25: The finished machine saw

POSTBAG

The Editor welcomes letters for these columns, but they must be brief. Photographs are invited which illustrate points of interest raised by the writer

HELPFUL AUTHOR

SIR,—Some weeks before the start of the ME Musical Clock series, by C. B. Reeve, I decided, with some trepidation, to "have a go" at the Calendar Clock described by him in ME during July and August 1951. My complete lack of horological knowledge soon led to snags, so at the 1956 exhibition I sought out Mr Reeve and asked his advice.

I would like to place on record my appreciation of the great pains he took to put me right on several matters concerning the clock, and his kindly manner when giving helpful guidance on various problems. His exquisite craftsmanship makes an ambitious target at which to aim in one's own efforts.

One of my problems was that of satisfactory gear-cutting, and Mr Reeve suggested the articles by J. C. Stevens in ME for January and February 1953. After my own experience using fly-cutters made by this ingenious method I can assure readers in a similar quandary that the gears produced are clean in finish, with well-formed, symmetrical teeth, and cost only a few pence for silver steel.

For division I use the head designed by Ian Bradley and described in his book *The Amateur's Workshop*. It works well and gives a very wide variety of divisions by meshing with different sizes of changewheels mounted on the lathe mandrel.

May I pass on one tip? For light drives such as fly-cutting the material known to dressmakers as bias-binding makes an excellent belt. When strongly stitched at the joint the drive is silent, there is no tendency to fray, and the material is very strong. One yard (2d.) will serve for cutting dozens of gears.

Petts Wood. A. J. WOOLF.

SHIP MODELLERS

SIR,—May I thank Mr Edward Bowness for the very excellent series of articles on *St Ninian*? These fully detailed descriptions and plans are, in my opinion, just what has been needed for many years. I express the hope that this will be followed by other ship designs. Ship modellers have waited a long time for this; the locomotive types have had it all their own way for many years!

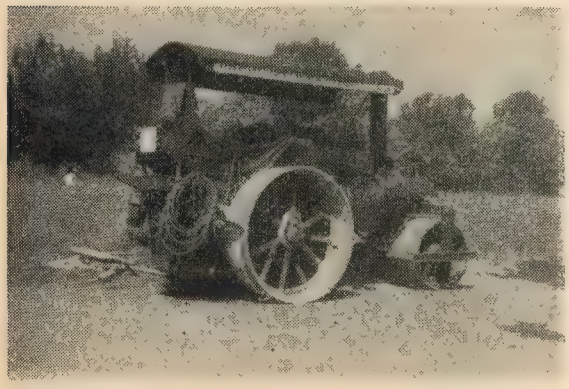
Rothley, R. S. FARMER.
Leics.

NO DERELICT

SIR,—I took this photograph outside a building site near Bookham, Surrey. Unfortunately, time did not allow me to record its number or maker, but, no doubt, our more knowledgeable enthusiasts will be able to identify it.

Its paintwork was very clean and a lot of the piping had been polished, and from the oily smell it appeared to have only just finished work and was by no means derelict.

Carshalton, A. BAILEY.
Surrey.



The sleeping steam roller which Mr A. Bailey photographed near to Bookham, Surrey

LOCO PIONEERS

SIR,—With reference to Nelson H. A. Moreton's letter [Postbag, October 24], it seems amazing that anyone sufficiently interested to visit the York Railway Museum should be unaware of the fame of Samuel Waite Johnson. It is even more incredible that in Bramley, the place of his birth, the memory of this noted locomotive engineer is not more justly honoured.

For your correspondent's information, Samuel W. Johnson came from the Great Eastern Railway to the Midland in 1873, where he reigned in charge at Derby for 30 years. His locomotive types achieved great renown, particularly the four classes of Singles of which the famous Spinners were perhaps the most notable. In this connection, these engines were the subject of an article by J. N. Maskelyne in his excellent series "Locomotives I Have Known."

Johnson also produced some fine 2-4-0s besides his excellent 4-4-0 types, of which one became the celebrated Class 3P. He was the instigator of the Midland three-cylinder compounds, later so successfully exploited by R. N. Deeley and H. Fowler respectively.

Perhaps S. W. Johnson is particularly esteemed for his artistry and his contribution to the aesthetic in locomotive design. With possibly Stroudley of the Brighton and Dean of the Great Western as his only peers, he epitomised that halcyon period of the late nineteenth century, when a successful locomotive was usually expected to boast a graceful appearance in keeping with its performance.

Mr Moreton rightly states that Johnson died in Nottingham in 1912. I understand that he moved to Nottingham before his retirement, travelling to Derby each day. It is thought also that he was a Justice of the Peace, but of this I am not certain.

Nottingham. J. R. SMITH.

SIR,—With regard to Matthew Murray, he was, while by no means the inventor of the locomotive, the first person ever to get upon the market with a locomotive as a practical working proposition. His greatest claim to fame, however, is that in 1802 he invented the locomotive type

slide valve, in contradistinction to the Watt long D-valve. Murray was also the first person to embody the feature of cranks at 90 deg. in a locomotive.

He was a native of Leeds, being born 1765 and deceased 1826. As partner in and founder of the firm of Fenton, Murray and Wood he designed and constructed the steam locomotives to the ideas of John Blenkinsop, which were constructed at his works in 1812 and 1813. These engines were fitted with rack pinnions to propel themselves upon the Middleton Tramway, Leeds. They had cast-iron boilers of oval section, the cylinders being vertical and driving the rack pinnion only. The rail wheels were not used for traction. The engines were named according to local accounts as follows.

A noteworthy point about the Murray engines was that for some years no feed pumps were fitted, the boiler holding enough water to take the engine its 3½ mile run.

Bishop's Stortford, Herts. G. WOODCOCK.

SIR,—Samuel W. Johnson was one of the greatest of all the late Victorian Locomotive Superintendents. A brief biography of him appeared in *The Locomotive*, I think, in Vol. 45, 1939.

He was, in the late 60s and early 70s, locomotive superintendent of the Great Eastern Railway, which post he relinquished to take up a similar appointment on the Midland Railway in succession to William Kirtley in 1873, in which latter post he continued until his retirement in 1903.

Incidentally, Johnson and Kirtley covered the locomotive superintendency of the Midland Railway for 60 years. Johnson was at one time president of the Institution of Mechanical Engineers.

Speaking from memory, it was he who introduced the lovely crimson lake painting of the Midland engines, which in Kirtley's time had been green; in passing, this colour is one of the most difficult of all to match in model work.

Johnson introduced steam sanding gear, the invention of a Derby locomotive works man, which did so much to prolong the usefulness of the single driver locomotive.

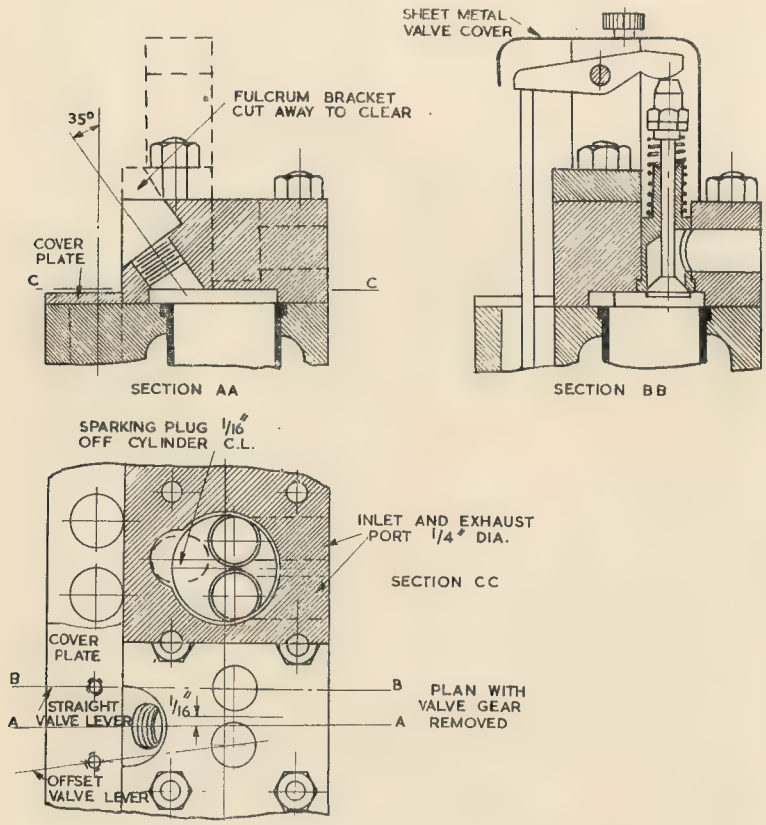
It is probable that his series of single-driving locomotives (there were 90 in all with drivers 7 ft 4 in., 7 ft 6 in. and finally 7 ft 9 in. dia.) were the best all round engines of this type ever built and they survived as a class far longer than any others of the type. The sole engine to outlast them was Caledonian No 123, which was the lone specimen of its type; they lasted (not all of them, of course) well into LMS times.

Two of Johnson's engines won the Grand Prix at Paris Exhibitions, the last one, *The Princess of Wales* in 1900, undoubtedly for symmetry and beauty of outline, being his crowning achievement.

Johnson was also responsible for developing the tender, to its generally accepted form with outside frames and springs above the axleboxes, but below the running plate or platform.

I had the privilege of meeting Mr Johnson after his retirement. He was not only a great engineer, but a very charming English gentleman.

Rustington, Sussex. K. N. HARRIS.



Details of the modifications to the Seal engine suggested by Cam

SEAL MODIFICATIONS

SIR,—Mr Curwen's advice on a possible high-performance head for the redoubtable Seal engine has produced not a little argument and discussion.

The enclosed drawing shows Mr Curwen's design modified by transferring the ports to the other side of the head. This would take the "bias" off the push rods, rockers and porting, thus greatly simplifying the machining operations. Also, the standard valve and port sizes, etc., may be retained.

As far as I can see, one of the few disadvantages of this arrangement is that the plugs have to go between the push rods, so that they are not quite so easy to get at—but a nice little box spanner would solve that one. Also, the neat Curwen valve cover would cover the plugs, too, which I do not like.

Another possibility is, of course, putting the camshaft up top, driven through a simple gear train from the front of the crankshaft, with simple follower fingers interposed between cams and valve end caps.

To make even another suggestion, perhaps someone would think up an overhead inlet side exhaust arrangement for this engine, with the present exhaust valve remaining where it is.

CAM.

Four views of the concrete ship at Shoreham showing it in stages of demolition

CONCRETE SHIP

SIR,—Some time ago there was some correspondence in ME about concrete ships and I mentioned there was one at Shoreham. I was interested to find recently that it was being broken up and I enclose four snapshots of the work in progress.

It was built about 1918 for carrying tar from the Portslade works of the Brighton Gas Co. to the tar distillery at Kingston. Apparently it was not too successful and laid on the river bank for some time.

When the wharf was extended at Kingston the ship was righted and the wharf filled in around it as shown, after which it was used for storage purposes only. The distillery has recently closed down, hence the reason for demolishing it. The amount of steel reinforcement in it was tremendous. No doubt the designers erred on the safe side with this early experiment.

Brighton 1. S. R. BOSTEL.

RUMANIA CALLING

SIR,—As a model engineer with thirty years' experience I am very interested in your journal and pleased with the variety of articles and subjects published in it.

I have a favour to ask. I should like to get into touch with a club, being especially interested in ship models, aeromodels, yachts and power boats.

Exchange of information might be of great advantage, as in our country these sports are very much practised, too, but as they are still relatively new we have not achieved your rich experiences.

I am mainly interested in literature for the international M class for aeromodels, for class B and associated power boats, as well as D and C classes.

Or. Stalin, DELINSKI ANATOLIE.
Strada Pavlov No 20,
R.P.R.—Rumania.

WELDING TORCH

SIR,—Regarding "Heat for Boiler Brazing" [Readers' Queries, October 31], several years ago I was given an out-of-date oxy-acetylene welding torch. It was what is now known as a low pressure model or ejector type.

After a few experiments by opening the burner nozzle out to about $\frac{3}{16}$ in. and the oxygen nozzle out a little with a sewing needle, squared at the point to make a form of reamer, I managed to get a really good hot flame.

Using coal-gas air mixture, this gadget is often used with a foot pump. Owing to the fine opening of the air jet, a long air line or a short one with a small air receiver to even out the fluctuations a little is needed.

Anyone who intends making an old welding torch ought to make sure that it is of the low pressure type for two reasons: (1) domestic gas is very low pressure, and the high jet velocity helps to draw gas through the torch; (2) I think the low pressure the most suitable for the job. It can be adapted easily by altering the existing jet and nozzle and by adding more burners and jets for different jobs.

Remember that the air line goes to the centre and the fine jet gas to the outer chamber and mixing tube.

Keighley, C. MAUDE.
Yorks.

WRONG NUMBER ?

SIR,—Mr G. Goldring, of Brighton [Postbag, October 31] writes about a Marshall portable steam engine which he saw between Crowfield and Horsham in Sussex. He says that the engine number is 10257.

In actual fact engine No 10257 was a 3 h.p. steam capstan engine and was sold to a Mr F. Melhuish, of Grimsby, on 6 January 1883, probably for use on a Grimsby trawler. I have no idea where Mr Goldring got his number from but the engine number should be on the steam chest cover on the cylinder side on the slide valve type, and on the cylinder back cover on the piston valve type. Unless it has been removed the engine number is bound to be on one of these two places.

If Mr Goldring happens to be anywhere near the engine again it would be interesting to know the correct number.

Britannia Works, H. D. MARSHALL.
Gainsborough.

DEFINITIONS

SIR,—Quoting from E.T.W.'s article of Oct. 31: "It is, however, necessary . . . to arrive at a clear definition of

what the terms relating to power and performance mean. There are many misconceptions on this matter . . ."

May I clear up some which appear in the next paragraph of his article ?

"Force" is quite literally "push" or "pull." "Weight" is, itself, a force—the force on a body due to gravity. The unit in which force is measured is the lb. wt (loosely referred to as the pound).

The "foot-pound" (strictly foot-pound-weight) is the unit of "work" or "energy."

"Work" is defined as force multiplied by the distance through which the force moves or, for a rotating shaft, torque × angle through which the shaft turns.

"Power" is the rate of doing work (or rate of using energy) or simply

$$\text{power} = \frac{\text{work done}}{\text{time taken}}$$

and is, thus, measured in ft-lb. wt/min. or horse-power as stated.

"Energy" is not an equation of force—time or anything else. It can most simply be defined as "stored work."

Perhaps, in closing, I may say that I enjoy E.T.W.'s articles more than any others in MODEL ENGINEER. Good luck to the present series.

CRANK.

PICKERING GOVERNOR

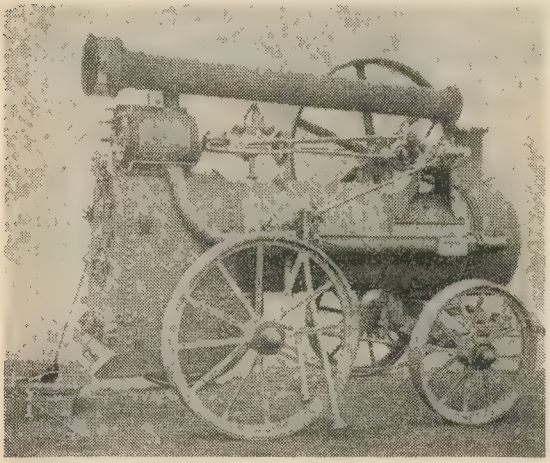
SIR,—There seems an awful lot of talk lately about Mr W. J. Hughes' Pickering governor, and it is some time now since I saw one. It may surprise Mr Hughes and, perhaps, many other readers likewise that some years ago Messrs. Pat Collins and Co., the well-known fairground operators, used one of these governors on a diesel engine—I think it was either a Leyland or a Fowler-Saunders—set up on a generator set on a trailer.

I am not mistaken at all in this statement as I was deputed to watch these diesels start up and I remember so well seeing this Pickering governor driven by belt from the engine shaft.

I wonder if our very good friend Mr. Hughes is in possession of *Machine Drawing Book I*, by Messrs T. and T. G. Jones (1920). On plate 57 he will find a beautiful Pickering Governor.

Incidentally, can anyone tell me what became of the firm of Armstrong Saurer of Newcastle upon Tyne ? They made a very fine vehicle once upon a time !

COLIN B. WHITEHALL.
Cefn Mawr, Denbs.



What do the experts know of this portable engine whose picture was discovered in an old album by Thomas Nelson, of Surrey

OLD PORTABLE ENGINE

SIR,—I came across the enclosed photograph in an old album in Warminster, Wilts. I thought it might be of some interest to experts on old portable engines. It is such a very good photograph for its period.

THOMAS NELSON.
Haslemere, Surrey.

USING A CLEANER

SIR,—I would like to reply to a couple of criticisms of my use of a vacuum cleaner for a gas blowpipe. One is in reply to M. G. D. Skelding [Postbag, October 24].

I always remove the endcap and dustbag before using the machine and I have a proper gas blowpipe with air and gas taps.

I turn on the gas, keeping the air supply closed, light up, switch on the blower then turn on the air. I claim this is perfectly safe.

The other criticism—that cleaners are short rated and liable to burn out [J. W. Cooper, Postbag, September 19]—well the machine I use (Vactric) does not get any hotter than usual, although I have had it in use for over an hour.

All the air used passes through the motor and helps to cool it. After all, all electric tools can overheat and burn out if used without care and common sense.

Only a few weeks ago I saw a *continuous rated* mains motor burn out through being over-worked.

E. F. GOUGH.
Birmingham 26.

SIR,—M. G. D. Skelding's letter about the gas explosion reminds me of an episode which took place in a small factory where I worked during the war.

A gas blowpipe with the bypass always alight was connected up to the works air supply by way of the original treadle bellows. One of the trainees, a Home Guard captain, dismantled a mills bomb and burned some of the powder on a brick by the blowpipe.

Two days later there was a shattering explosion which brought the boss running from his office. The captain was accused by everyone of endangering our lives and was duly sacked, though he strongly maintained his innocence.

We all settled down to work again confident that the works were then a safer place, but a week later there was another bang, from the forge this time, blowing the bellows inside out.

As there was no one left to blame we correctly diagnosed the cause to a certain amount of gas from the bypass gradually filling the bellows via the air pipe until the correct explosive mixture was reached for the flame to ignite.

H. A. JONES.
Beaumaris, Anglesey.

ROSE . . .

continued from page 742

Reverse the axle and repeat the operation on the other end, making the distance between shoulders of wheel seats 2 9/32 in., then press on the wheels using the vice as a press. Put a piece of soft metal between the end of the axle and the vice jaw, and a bush between the jaw and wheel at the other end to allow the axle to come through the wheel. Spin each pair between temporary bearings to check for truth before erecting in the frames.

● *To be continued*

CLUB NEWS

EDITED BY THE CLUBMAN

ONE of the clubs hit by Asian flu, or whatever one cares to call it, is the Merseyside Model Railway Society. The illness affected attendances at the Grenville Cafe lectures, cancelled a demonstration of tree-making, and brought work on the TT3 layout to a complete stop.

Fortunately the attack seems to have passed. R. R. Thomas is to give his demonstration on another date, and Cyril Smith and his comrades have tackled the layout with renewed vigour. Even in October, one of the two worst months, enough members were on their feet to send a display of their models to the Chester Exhibition.

When the Manchester Exhibition opens next month **Merseyside MRS** will be there with a stand full of good things. Members are also looking forward to their annual dinner at the Woodside Hotel in Birkenhead on January 18 when Geoffrey Platt, the guest speaker, is to speak on the old LNWR, from full-scale and model standpoints, with the help of photographs and lantern slides. Earlier, on December 11, Bob Hunter is giving a film show at the Grenville Cafe.

The cafe stands in Tithebarn Street, Liverpool; the club rooms, which open every Friday night at 7.30, are at 102 Chester Street, Birkenhead, and secretary A. L. Eagles, who invites inquiries, will be found at 38 Silverdale Road, Bebington, Wirral, Cheshire.

There is at least one consolation in this onslaught of Asian flu: those who have fallen to it are less likely to be knocked out at Christmas. I hope that all the Merseyside members will be able to attend their annual dinner —and enjoy it !

NOTHING FELL OFF !

The influenza has been moving West. I do not know if it has yet paid a formal call in Exeter and area, but when I last heard from **Topsham Model Engineering Society** everybody was busy and members had finished about 100 ft of the permanent up-and-down line which they are building in 3½ in. and 5 in. gauge to a length of 200 ft on their quay at Topsham. The project was made practicable by the permission of Heywood and Son Ltd, of Exeter, to whom the society is, of course, grateful.

To help the recreation ground fund the club staged a miniature railway ride at Topsham town fete. President Tom Spike ran his freelance 2-6-2 tank in 3½ in. gauge and in three hours carried more than 300 passengers, two and three a trip, without any bits falling off the engine.

AMERICA'S OLDEST

From the West let's sputnik back to London a moment. As regular readers of the diary will have noticed, **Thames Shiplovers and Ship Model Society** is having a pleasant winter. Following Dudley Pope's illustrated talk of November 22 on the Battle of the River Plate (Dudley Pope, you will remember, wrote a famous account of the battle) Donald T. Adams is speaking with similar authority on the United States Coastguard, in which he is a captain.

All who go to the Baltic Exchange in London for this talk on December 13 will hear a first-hand account of America's oldest armed service. May I suggest to other ship societies that it should be well worth their while to seek out, through the American authorities in England, an occasional speaker on some aspect of America's history at sea ?

Everyone who reads this page is welcome at the Thames Shiplovers' meetings. Besides those at the Baltic Exchange (24 St Mary Axe, EC3) others of especial interest to ship modellers are held at Oddi's Restaurant in Coptic Street, off the north side of New Oxford Street opposite the junction with Shaftesbury Avenue. Here the time is 7 p.m., half an hour later than at the Exchange.

For the Oddi's meeting on December 6 there will be no set subject. Members are asked to bring models, plans, books, tools and suggestions for a general discussion.

Secretary John H. Fisher has changed his address and is now at 106 Chester Drive, North Harrow, Middlesex.

NEW PREMISES

Another address to have changed is that of **Croydon SME.** This society has moved to new premises at the Lindfield Social Club's ground, an extensive area for which a permanent multi-gauge continuous rail layout is being designed. K. N. Harris liked the place when he arrived there recently to deliver an interesting talk.

Those who wish to join in time for the attractive winter programme should write without delay to secretary E. R. Van-Cooten at 29 Kingsdown Avenue, South Croydon, Surrey.

ME DIARY

November 28 Gauge 1 MRA, Gauge 1 track night of MRC, Hammersmith.
Hull SME Brains Trust.

November 30 West Riding SLS annual social, Guildford Hotel, Leeds, 3 p.m.
SMEE meeting. "Stationary Engine," headquarters, 28 Wanless Road, SE24, 2.30 p.m. Visitors invited.

December 5 Eltham and District LS, "My 5 in. gauge Adams loco," A. Brock, Beehive Hotel, 8 p.m.
Huddersfield SME, "Philosophy of a Railway Enthusiast," W. Stocks, 7.30 p.m.

December 6 Thames Shiplovers club night, Oddi's Restaurant, Coptic Street, London, 7 p.m.
Rochdale SMEE "Boiler Making," J. Clegg, Lea Hall, 7.30 p.m.
Malden SME bits and pieces.

December 7 Gauge 1 MRA annual meeting, MRC, Hammersmith, London.
REC. Christmas film.
Bristol SMEE annual meeting, Folk House, 7.30 p.m.

December 8 IRCMS at Kingsley Hotel, London.

December 9 Institution of Engineering Designers, "Doxford Marine Diesel Engine," J. A. Hardy, Northern Association Hall, Newcastle upon Tyne, 7.15 p.m.

December 11 Birmingham SME, "Genevieve," Crown Hotel.
Merseyside MRS, film show, Bob Hunter, Grenville Cafe, Tithebarn Street, Liverpool.

December 12 Hull SME, Best Model of the Year Exhibition (entries, please).
Huddersfield SME, annual dinner, Heywood's Cafe, Market Street, Huddersfield, 7.30 p.m.

December 13 Malden SME, rummage sale.
Warrington MES, "Extrusion of Non-ferrous Metals," illustrated talk.

December 14 Glasgow SME, film show, R. Kerr of Kirkintilloch SMC.
Railway Enthusiasts' Club, colour-slide show, R. C. Riley.

December 18 Bristol SMEE, film show in lighter vein, Folk House, 7.30 p.m.
Leicester SME, annual meeting.

December 20 Malden SME, "Model Loco Building: Choice and Cost."
Birmingham Ship Model Society, "Ship Lines and Plans for Modellers," A. E. Field.
Warrington MES, Christmas gathering, Royal Oak, Bridge Street, Warrington.
Rochdale SMEE general meeting, Lea Hall, 7.30 p.m.

December 21 Railway Enthusiasts' Club, "Railways on Records," railway music, songs and sounds.

A. BEAUMONT offers a reliable method for making

ENGINE ROOM CHEQUER PLATES

A FEW years ago the Editor sought readers' solutions to the old problem of making diamond chequer plates with the correct raised rib pattern. But, following many suggestions, it became apparent that a permanent solution was not likely to be forthcoming.

Being interested in the subject I got down to some experimental work. The result: a method which, I believe, will give entire satisfaction right down to $\frac{1}{2}$ in. scale provided care is taken with the preliminary work.

Full size chequering varies somewhat in "diamond" sizes and $3\frac{1}{2}$ in. $\times$ $2\frac{1}{8}$ in. appears to be a reasonable average; furthermore small engines need not have small pattern plates and vice versa.

THE DIE BLOCK

Determine the size of plate lozenge required for reproduction (Fig. 1). On a piece of flat m.s., at least $\frac{3}{8}$ in. thick and squared to dimensions which can be manipulated in the lathe vertical slide, set out a few trial pencil lines with a bevel gauge. This is merely to give an impression of the finished job.

By reference to the chosen scale select a small lathe slitting saw about 0.01 wider than the width of raised ribs on the chequer plate. Set up the m.s. block in the vice on the vertical slide, working face up and check that the upper surface is parallel to lathe bed. Swing the vertical slide to the required angle on the cross slide (check with the bevel gauge) and note the vertical slide angular reading.

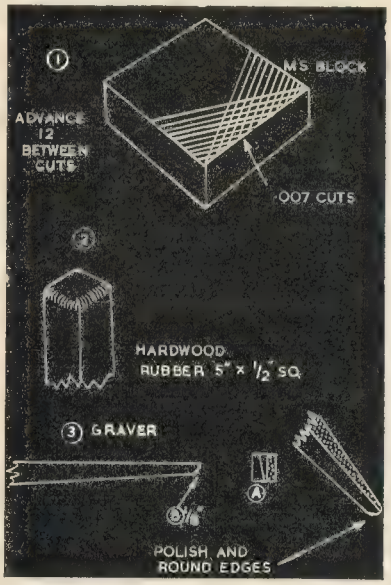
The leadscrew hand wheel, if indexed, should be used to advance the work under the slitting saw the desired spacing between the ribs of plate. Next put on the cut of saw by raising the vertical slide. For 1 in. scale a depth of cut of 0.007 is about right. Traverse the work under the saw, and, by reversing the block and also the angular setting of the vertical slide, a diamond saw-cut pattern can be completed over the whole top surface of the m.s. block.

In my case the work piece was 2 in. $\times$ 2 in., but with good sawing equipment and a large lathe, the dimensions may be increased.

Example: 1 in.-$1\frac{1}{2}$ in. scale. Saw-cut pattern 0.007 deep $\times$ 1/32 in. wide. Leadscrew advance 0.12 between cuts. Angle of vertical slide 29 deg. Size of finished lozenge approximately 15/64 in. $\times$ $\frac{1}{8}$ in. centre to centre.

THE PLATE MATERIAL

Copper sheet 0.003-0.005 in. thick. Cut a piece to overlap the saw-cut block by about $\frac{1}{2}$ in. on the opposite sides and to full dimensions on the other two opposite sides. Anneal thoroughly and evenly, and clean well on both sides. Heat on a metal plate



and add Baker's fluid to the upper surface with a very small touch of solder paint. Brush well and so obtain an even, very thin tinning. Clean well with methylated spirit. Heating for a minute or so will give a harder tinning which seems to penetrate the copper.

Fold over the sheet on the opposite sides of the steel block and grip the two firmly in the bench vice (saw-cuts uppermost and now hidden by the copper).

THE RUBBER

Prepare a piece of close-grained hardwood about $\frac{1}{2}$ in. square and 5 in. long. Round the four edges of one end and finish highly with fine glass-paper (Fig. 2).

Smear the copper with grease, and work the polished stick lightly over the sheet with a circular motion; very soon the underlying saw-cuts will show on the copper, but no attempt should be made to work the copper into them.

THE GRAVER

Make up or alter a hard steel tool as shown (Fig. 3) and polish the working end; although thin it must on no account present a cutting edge to the work, but must be rounded all over.

Radius *B* about $\frac{1}{8}$ in. Width at *A* is width of saw-cuts less once thickness of copper sheet. Although this dimension is not vital, it is obvious that the copper must be given some room to pass into the saw-cuts.

FORMING THE CHEQUER PATTERN

Well grease the copper again. Hold the tool at about 30 deg. to the work, very gently run along each line on the copper, doing every one on both angles. Keep the work well greased and increase the pressure and angle of application of the graver.

Eventually, after three or four complete passes over the work, a perfect reverse chequer plate is formed, and, on removing the work from the vice, the tinned side shows a perfect plate. In working over with the graver, the copper does not rise between the sawcuts. Should this take place for any reason simply flatten it with the wood rubber.

The plate is quite rigid, but may be cemented to a backing piece if required.

One of the many advantages of this method is rapidity of production from the die block when made. Four square inches of plate take seven to ten minutes, including tinning. A gentle brass wire-brushing on the tinned side and a coat of thin metal lacquer will give a permanent steel-like finish. ▣

Model Engineer

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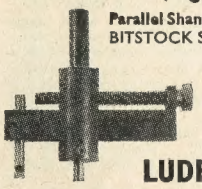

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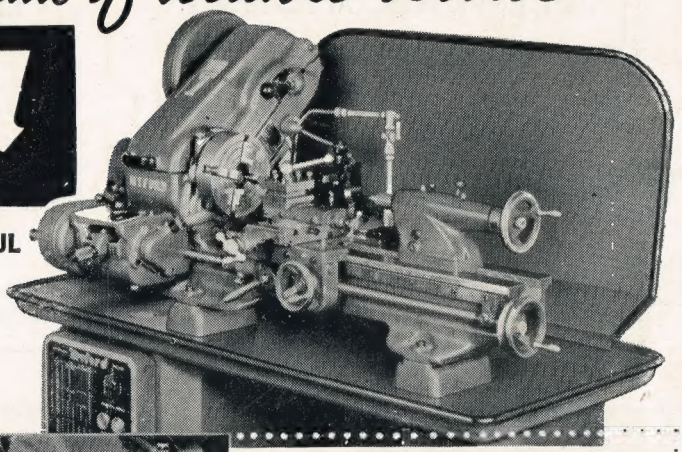

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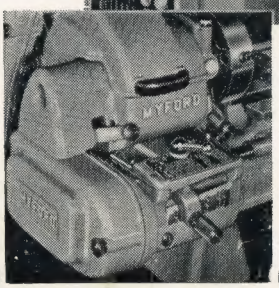

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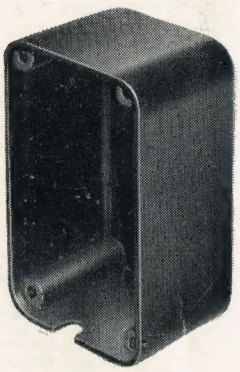

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